BACK

MEDIUM VOLTAGE VACUUM CIRCUIT BREAKERS

Type VCP-W Vacuum Circuit Breakers

ANSI 5/15 kV at 1200-3000 Amperes
250-1500 MVA, 60-95 kV BIL

IEC 3.6/17.5 kV at 630-2000 Amperes
25-40 kA, 40-95 kV BIL

The leading value-added modular approach for assembling metal-clad switchgear featuring Cutler-Hammer medium voltage vacuum circuit breakers, structures and accessories.

OEM SWITCHGEAR COMPONENT PRODUCTS

EATON | Cutler-Hammer

The Industry Leader in Vacuum Circuit Breakers

VacClad-W, the Cutler-Hammer vacuum switchgear family, has been engineered to feature a standardized design, interchangeable parts, slot and tab construction, and industry-leading vacuum interrupter technology. This world class switchgear includes the Type VCP-W Vacuum Circuit Breaker which meets both ANSI and IEC electrical standards.

Industry-Leading Vacuum Technology Provides Unequaled Reliability

Cutler-Hammer now provides the industry's most complete family of technologically advanced vacuum circuit breakers at 5 kV, 15 kV, 27 kV, and 38 kV. Type VCP-W Vacuum Circuit Breakers incorporate many design features which have been field proven with more than 25 years of vacuum interrupter design and manufacturing experience…coupled with over 70 years of power circuit breaker design and manufacturing experience.

Type VCP-W Vacuum Circuit Breakers are available in a complete range of ANSI and IEC ratings:

ANSI 5 kV through 38 kV, continuous currents from 600 through 3000 amperes.

IEC 3.6 kV through 36 kV, continuous currents from 630 through 2000 amperes.

ISO Certified Facilities

Type VCP-W Vacuum Circuit Breakers, including the vacuum interrupter, are assembled by Cutler-Hammer in ISO 9002 certified facilities. The breakers are fully tested to ANSI and IEC standards and each is provided with its unique Quality Assurance Certificate that documents all tests and inspections performed.

Assembly Flexibility

Assembly flexibility is provided with a variety of industry leading value-added approaches for assembling premier metal-clad switchgear. Customers have the unique opportunity to select the appropriate building block approach to match their manufacturing capabilities with those of Cutler-Hammer.

The OEM Value-Added Approach to Circuit Protection… Flexibility that Exceeds the Customer's Requirements

Type VCP-W Vacuum Circuit Breakers

Industry Leading Vacuum Technology in ANSI 5/15 kV or IEC 3.6/17.5 kV

- *Type VCP-W.*
- *Type VCPW-SE.*
- *Type VCPW-ND.*

Power Modules

Complete Structures Including Fully Equipped Breaker Compartment and Auxiliary Provisions

Mini Modules

A Simple Building Block Approach Easily Configured to Any Project Specification

Mini Modules Configured as:

- *A One-High Fully Equipped Breaker Compartment for 1200, 2000, or 3000 Amperes.*

Circuit Breaker Compartment Kits

Provide the Opportunity to Add the Most Value and Include All Key Breaker/Cell Interfacing Parts Necessary to Build a Breaker Compartment

Auxiliary Drawer Compartment Kits

All Parts Necessary for Building Potential Transformer, Control Power Transformer, or Fuse Drawer Compartments

Tools and Accessories

A Complete Selection of Standard and Optional Tools and Accessories

5/15 kV Medium Voltage Breaker Rating Chart

ANSI Standards – Type VCP-W Vacuum Circuit Breaker Rated on Symmetrical Current Rating Basis①

Identification			Rated Values												Weight
Circuit Breaker Type	Nominal Voltage Class	Nominal 3-Phase MVA Class	Voltage		Insulation Level		Current		Interrupting Time④	Permissible Tripping Delay	Maximum Voltage Divided by K	Current Values			
			Maximum Voltage	Voltage Range Factor③	Withstand Test Voltage		Continuous Current at 60 Hz	Short Circuit Current (at Rated Maximum kV)				Maximum Symmetrical Interrupting Capability	Closing and Latching Capability	Closing and Latching Capability Momentary	
					Power Frequency (1 Minute)	Impulse						K Times Rated Short Circuit Current③	2.7 K Times Rated Short Circuit Current	1.6 K Times Rated Short Circuit Current	
			E	K				I		Y	E/K				
	kV	MVA	kV rms		kV rms	kV Peak	Amperes	kA rms	Cycles	Seconds	kV rms	kA rms	kA Peak	kA rms	lbs.
50VCPW-ND250	4.16	250	4.76	1.24	19	60	1200	29	5	2	3.85	36	97	58	345
50VCP-W250	4.16	250	4.76	1.24	19	60	1200 2000 3000	29	5	2	3.85	36	97 132②	58 78②	350 410 525
50VCP-W350	4.16	350	4.76	1.19	19	60	1200 2000 3000	41	5	2	4.00	49	132	78	460 490 525
75VCP-W500	7.2	500	8.25	1.25	36	95	1200 2000 3000	33	5	2	6.60	41	111	66	375 410 525
150VCP-W500	13.8	500	15.00	1.30	36	95	1200 2000 3000	18	5	2	11.50	23	62 97②	37 58②	350 410 525
150VCP-W750	13.8	750	15.00	1.30	36	95	1200 2000 3000	28	5	2	11.50	36	97 130②	58 77②	350 410 525
150VCP-W1000	13.8	1000	15.00	1.30	36	95	1200 2000 3000	37	5	2	11.50	48	130	77	460 490 525
150VCP-W1500	13.8	1500	15.00	1.00	36	95	1200 2000 3000	63	5	2	15.00	63	170	101	525 530 550

IEC-56 Standards – Type VCP-W Vacuum Circuit Breaker Rated on Symmetrical Current Rating Basis⑥

Identification		Rated Values								Weight
Circuit Breaker Type	Voltage Class	Insulation Level		Normal Current	Short Circuit Breaking Current	Short Time (3 Second) Current	Short Circuit Making Current	Cable Charging Breaking Current		
		Power Frequency	Impulse Withstand							
	kV rms	kV Peak	kV Peak	Amperes	kA rms	kA rms	kA Peak	Amperes		kg
36VCPW-ND25 36VCPW-ND32	3.6 3.6	10 10	40 40	630, 1250 630, 1250	25 31.5	25 31.5	63 79	25 25		159 159
72VCPW-ND25 72VCPW-ND32	7.2 7.2	20 20	60 60	630, 1250 630, 1250	25 31.5	25 31.5	63 79	25 25		159 159
36VCP-W25 36VCP-W32 36VCP-W40	3.6 3.6 3.6	10 10 10	40 40 40	630, 1250, 2000 1250, 2000 1250, 2000	25 31.5 40	25 31.5 40	63 79 100	25 25 25		188 188 225
72VCP-W25 72VCP-W32 72VCP-W40	7.2 7.2 7.2	20 20 20	60 60 60	630, 1250, 2000 1250, 2000 1250, 2000	25 31.5 40	25 31.5 40	63 79 100	25 25 25		188 188 225
120VCP-W25 120VCP-W32 120VCP-W40	12 12 12	28 28 28	75 75 75	630, 1250, 2000 1250, 2000 1250, 2000	25 31.5 40	25 31.5 40	63 79 100	25 25 25		195 195 225
175VCP-W25 175VCP-W32 175VCP-W40	17.5 17.5 17.5	38 38 38	95 95 95	1250, 2000 1250, 2000 1250, 2000	25 31.5 40	25 31.5 40	63 79 100	31.5 31.5 31.5		195 195 225

① Applicable ANSI standards C37.04 - 1979, C37.09 - 1979, and C37.06 - 1987. Operating duty cycle CO-15 seconds-CO. Operating time values: opening 30-45 ms, closing 45-60 ms and reclosing 18 cycles (300 ms).

② Nonstandard circuit breakers with High Close and Latch (momentary) rating for special applications.

③ Consult Application Data 32-265 for further information.

④ Optional interrupting time of 3 cycles is available.

⑤ Also 3 second short time current carrying capability.

⑥ Interrupting time is 3 cycles at 50/60 Hz. Rated operating sequence: O-3 minutes-CO-3 minutes-CO.

Metering, Protection, and Communications

Cutler-Hammer Power Management Products provide the solutions to monitor and manage all aspects of an electrical distribution system. These innovative meters, relays and communications software applications make it possible to realize greater reliability, increased productivity and significant cost savings.

METERS

IQ Analyzer 6400/ 6600 Series

The Premier Power Quality Meter

The IQ Analyzer provides comprehensive diagnostic capabilities with over 150 metered values. This device assists in preventing process disruptions and equipment damage by storing trends, analyzing harmonics and capturing waveforms. Historical data captured by the IQ Analyzer helps to identify problems in an electrical distribution system. Energy usage and costs are controllable through highly accurate energy measurement, on-board energy value storage and time-of-use energy registers. Optional graphical waveform and harmonic spectrum display available on the 6600 series.

IQ DP-4000

Metering and Voltage Protection

The IQ DP-4000 provides complete electrical metering and system voltage protection. This device measures and displays over 74 electrical system values. It measures % total harmonic distortion (%THD) for both current and voltage to help find the source of problems. The IQ DP-4000 keeps track of total energy used along with the maximum demand to aid in energy management. Optional digital I/O available on the 4100 series.

IQ 200

Switchboard Metering

The IQ 200 family is a group of revenue accurate ANSI C12.16 meters that provide big features in a small and flexible package. They are ideal for panelboard and switchboard applications where panel space is at a premium. Energy management information is provided by direct reading of metered values. With built-in communications the IQ 200 base can be used as a metering transducer for submetering applications.

PROTECTIVE RELAYS

MP-3000

Award-Winning Motor Protection

The MP-3000, winner of a Plant Engineering magazine Product of the Year award, protects three-phase induction motors of any size and voltage. Integral Intel-I-Trip™ overload protection develops protection curves based on motor data and adaptive characteristics based on measured RTD temperatures. The MP-3000 records motor history and time-stamped event logging in nonvolatile memory. This device is available in a quick-release drawout case model.

FP-5000

Integrated Protection, Metering and Control for Electric Power Distribution

The FP-5000 provides advanced protection for mains, tiers and feeder circuits of any voltage level. This device provides complete three-phase and ground protection, time overcurrent protection with 11 user-selectable characteristic curve shapes, three custom curves, over and under voltage and frequency protection, phase sequence voltage protection, current unbalance protection and breaker failure protection. It provides complete metering and advanced data logging capabilities. The FP-5000 is available in a quick-release drawout case model.

Digitrip 3000

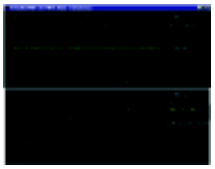
Increased Protection for Medium Voltage Circuit Breakers

The Digitrip 3000 provides three-phase and ground overcurrent instantaneous protection in a single, cost-effective package. It also provides current and monitoring capability. Optional zone selective interlocking is an alternative to high bus cost differential protection. The selectable long time curve slope (ANSI: Moderately inverse, very inverse, and extremely inverse and thermal curves: It, T^2t, T^4t, flat) provides protection for a wide range of protection capability in a single device.

COMMUNICATIONS

PowerNet

Flexible Power Management System



PowerNet software is designed to manage the power distribution system. It's ideal for managing energy usage and costs, troubleshooting power quality problems and ensuring the reliability and integrity of the electrical distribution system. A PowerNet Power Management System consists of PowerNet software networked with meters, relays, trip units, motor protectors, starters and transfer switch controllers. PowerNet has an extensive library of third-party interfaces, facilitating integration with other manufacturers' devices and building management systems.

PowerPort

Single Device Monitoring and Configuration Software

PowerPort is free software downloadable from http://www.ch.cutlerhammer.com/pmp/PowerPort.html. It is a scaled-down version of Power Net. PowerPort simplifies the setup and configuration of select Cutler-Hammer devices, including the IQ Analyzer, MP-3000 and FP-5000, by enabling the user to enter the device setpoints via a user-friendly PC interface. Then the information can be downloaded to the device, eliminating the need to scroll through the device menu at the faceplate. A single device can be monitored via PowerPort.

GENESIS32™

Web-Based HMI Software

GENESIS32 is Cutler-Hammer's graphical solution and includes GraphWorx, TrendWorx, AlarmWorx and Web HMI software. The basic bundle also includes an integrators tool of Modbus to OPC to facilitate the communications with Modbus devices in your network. These applications provide customized graphical displays, ease of integration and portability of data throughout the enterprise network, even via a web browser thin client. This bundle provides the flexible and powerful graphic applications that are easily deployed.

GENESIS32 is a trademark of ICONICS.

ACCESSORIES

EZC Minalites®

Compact indicating lights for general indicating or signaling. They are quickly and easily mounted on panels up to and including 1/4 inch in thickness. Round and rectangular designs are available.

Industry Leading Vacuum Technology Enhances Breaker and Switchgear Reliability

Type VCP-W Vacuum Circuit Breakers

The highly dependable performance of Cutler-Hammer vacuum circuit breakers results from our commitment to a continuing research and development program.

Beginning with early research in 1929, we have been a leader in the vacuum interrupter field. Production was launched in the mid-1960s, and since that time hundreds of thousands of vacuum interrupters have been in reliable operation worldwide.

Cutler-Hammer experience has resulted in many significant vacuum interrupter breakthroughs including:

- Copper chrome contact materials that provide longer life.
- A smaller envelope size with higher performance.
- Lower chop currents.
- Improved dielectric strength.

Consequently, Cutler-Hammer vacuum interrupters are maintenance free…and provide increased service life and optimum operator safety.

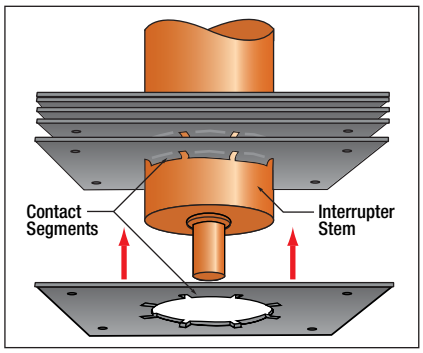
World-class VCP-W Vacuum Circuit Breakers designed with a patented V-Flex nonsliding current transfer system.

Type VCP-W Vacuum Circuit Breakers Are Designed with the Patented V-Flex Nonsliding, Nonrolling Current Transfer System

The current transfer system consists of a series of tin-plated, high-conductivity copper leaf conductors that are swaged onto the movable interrupter stem.

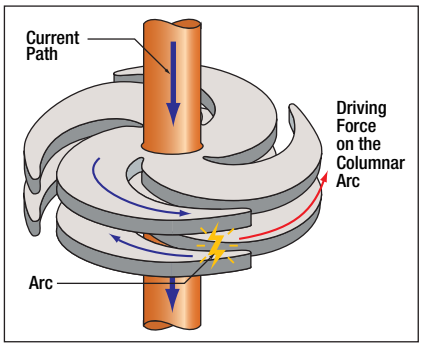
Unique swaged design benefits include:

- Improved current flow because the multipoint contact offers very low electrical and thermal resistance.
- Unlike sliding or rolling designs, there are no moving parts to wear out…therefore, no maintenance.
- Longer circuit breaker service life.



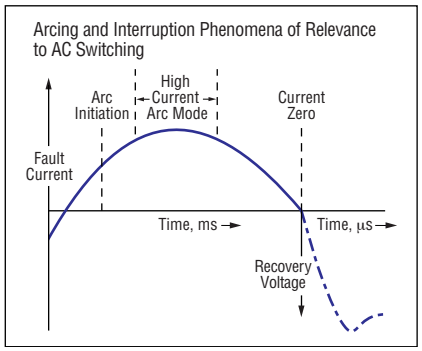
Nonsliding Current Transfer System

Connecting each leaf conductor to the vacuum interrupter stem initiates a flattening operation of the segments which are, in turn, swaged into contact with the stem. Each leaf, therefore, provides a multipoint connection. As the stem moves up and down, the V-Flex system flexes, eliminating the sliding action to provide a minimal wear and maintenance-free system.



Arcing and Interruption in Vacuum

Inside the vacuum bottle, the spiral contact design configuration provides a self-induced magnetic effect that moves the arc root around the contact periphery. This type of arc control prevents hot spot formations and minimizes electrode erosion. The low resistance of the spiral design results in less heat to dissipate, providing the smallest possible envelope size.



Arcing and Interruption Phenomena of Relevance to AC Switching

The important arcing and interruption phenomena that occur during fault current interruption in a vacuum are depicted above. These phenomena influence the design of the interrupter, particularly its size, configuration, and material of the contacts. Full dielectric strength is re-established to withstand transient recovery voltage (TRV) within a few microseconds, the fastest available.

Type VCP-W Vacuum Circuit Breaker… A New Level of Standardization

All Type VCP-W Vacuum Circuit Breakers, regardless of voltage or interrupting capacity, have the same time proven stored energy mechanism…and are significantly smaller than conventional medium voltage drawout breakers in *both* size and weight. Refer to weights table on page 11.

Three Methods of Easy Installation

Lower Compartment Installation

1. A roll off the floor ramp.
2. A dockable dolly.
   The floor ramp or dockable dolly is used for quick lower cell installation or removal.

Upper and Lower Compartment Installation

3. A lifting yoke that is compatible with any standard lifting device.

Since the breaker rides on extension rails, alignment problems are eliminated and installation time is reduced. Additionally, a position indicator shows when the breaker is in the fully connected or disconnected position.

Designed for Operator Safety

Two dead front shields are provided to isolate the operator from high voltage when the breaker is energized.

During levering, safety interlocks render the breaker mechanically trip free and the breaker is grounded throughout its travel. The "T" handle latch which engages and disengages the breaker is at the bottom of the breaker, far from energized parts.

When the breaker is withdrawn, steel shutters automatically rotate to cover the primary disconnect supports…and a current transformer barrier is located in front of the shutters. This prevents the operator from accidental contact with primary voltage parts and controls.

VCP-W Vacuum Circuit Breaker Compartment

1. Metal shutters
2. Ground stab assembly
3. Breaker position indicator
4. Levering mechanism
5. MOC/TOC switch location
6. Drawout type secondaries

VCP-W Vacuum Circuit Breaker

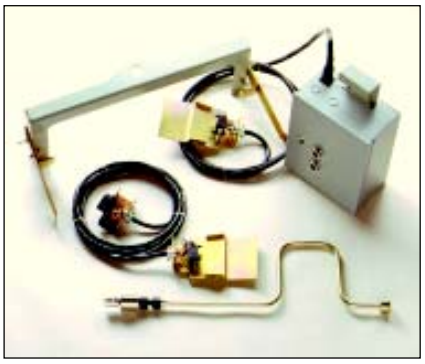
7. Vacuum interrupter
8. Patented V-Flex nonsliding, non-rolling current transfer system
9. Direct reading contact erosion indicator
10. Breaker wheels
11. Removable glass polyester insulating barriers

12. Front panel controls and indicators
13. Removable dead front cover
14. "T" handle latch
15. Drawout type secondaries

Tools and Accessories

Cutler-Hammer provides several standard and optional accessories including equipment used to transport the breaker and lift and lever it into a compartment, as well as a manually operated ground and test device.

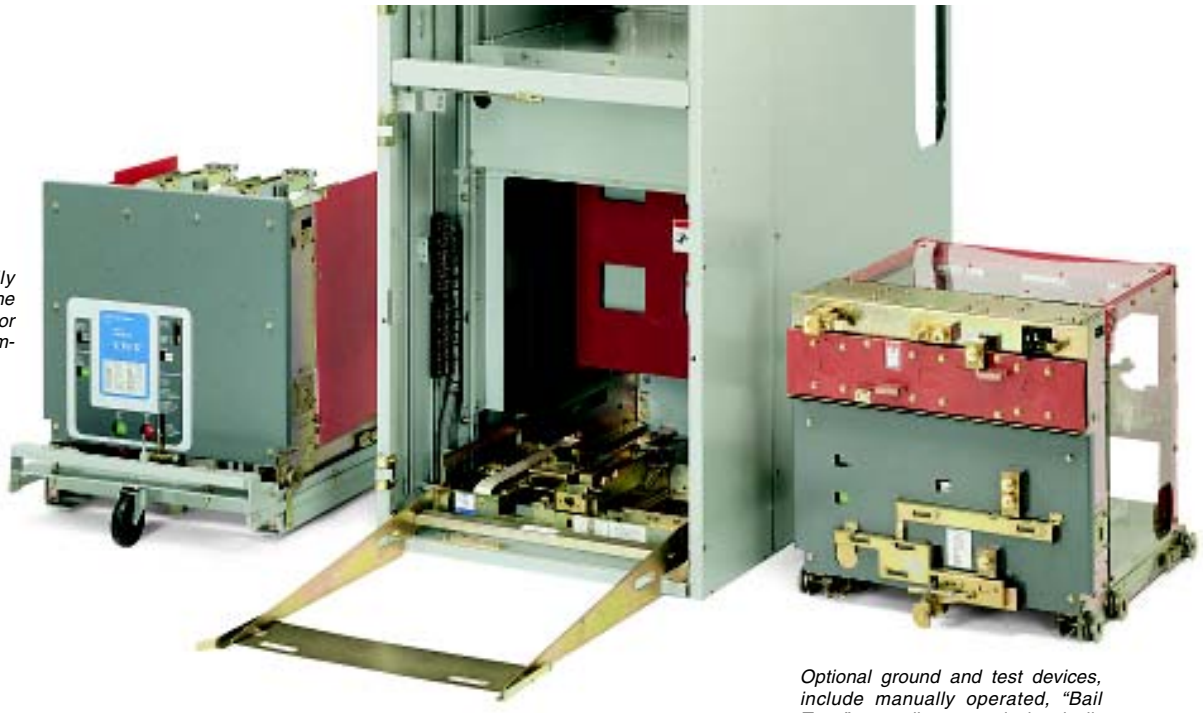
The optional portable lifter is used to lift the breaker from or onto the extension rails.



Optional accessories include (clockwise): lifting yoke, test cabinet, spin-free levering crank, and test jumper.

Standard accessories include (top to bottom): manual charging handle, left and right removable extension rails, rail clamps, and levering crank.

A dockable dolly for transporting the lower breaker to or from the lower compartment.



A roll off the floor ramp is used to move the lower breaker from the floor to the bottom compartment.

Optional ground and test devices, include manually operated, "Bail Type" manually operated, electrically operated, and "Consolidated Edison" user type (shown). Dummy elements are also available.

Auxiliary Drawer Compartment Kits for Power Modules, Mini Modules, or Breaker Compartment Kit Value Added Approaches

These kits include all major parts used in assembling an auxiliary compartment. Each kit is shipped in a single carton with detailed instructions and drawings that include important dimensions, clearances and configurations. Power Module B-Planes are prepunched to accommodate any auxiliary compartment kit.

Potential Transformer Drawer Kit

UL Recognized

Parts include:

- Left and right drawout rails.
- PT truck assembly. (Potential transformers and fuse mountings are not included.)
- Primary and secondary contact assemblies, standoff insulators, and cable supports.
- Shutter assembly.
- Hardware for cell mountings and alignment brackets.
- Horizontal sectioning barriers.
- Drawings are provided for manufacturing the back sheet. They also detail the clearances and locations of integral parts.
- Detailed assembly instructions.
- Available for 36 inch wide standard and 26 inch wide narrow design switchgear configurations.

Control Power Transformer Drawer Kit

UL Recognized

Parts include:

- Left and right drawout rails.
- CPT truck assembly including glass polyester barriers and secondary fuse mountings. (Control power transformers are not included.)
- Primary and secondary contact assemblies.
- Shutter assembly, standoff insulators, and cable supports.
- Hardware for all configurations and alignments including mounting and alignment brackets.
- Horizontal sectioning barriers.
- Drawings are provided for manufacturing the back sheet. They also detail the clearances and locations of integral parts.
- Detailed assembly instructions.
- Available for 36 inch wide standard and 26 inch wide narrow design switchgear configurations.

Fuse Drawer Kit

UL Recognized

Parts include:

- Left and right drawout rails.
- Fuse truck assembly including fuse holder assembly and various fuse mountings. (Fuses are not included.)
- Primary contact assemblies.
- Shutter assembly, standoff insulators, and cable supports.
- Hardware for all configurations and alignments including mounting and alignment brackets.
- Horizontal sectioning barriers.
- Drawings are provided for manufacturing the back sheet. They also detail the clearances and locations of integral parts.
- Detailed assembly instructions.
- Available for 36 inch wide standard and 26 inch wide narrow design switchgear configurations.

Cutler-Hammer Vacuum Circuit Breakers Are Convenient to Operate, Simple to Inspect, and Easy to Maintain

User-Friendly Operation

Type VCP-W Vacuum Circuit Breaker controls and indicators are functionally grouped on the front control panel and include: contact position indicator, closing spring status, close and trip button, operation counter, and a breaker "T" handle latch (located at the bottom of the control panel).

The simplified design includes just five major components: vacuum interrupter pole units, stored energy mechanism, push rod assembly, primary disconnecting contacts, and removable glass polyester insulating barriers.

Convenient Inspection

The breaker is withdrawn on removable extension rails and no separate lifting device is required. There is no need to remove the breaker from the switchgear. With the breaker withdrawn, both the compartment and contact erosion indicator, and "T" cutout loading spring indicator can be visually inspected.

Both stored energy mechanism and control components are conveniently located behind the easily removed front panel. The current transformer barrier is easily removed for inspection and access to the current transformers. Auxiliary drawers use extension rails to provide for easy inspection and fuse replacement.

Easy Maintenance

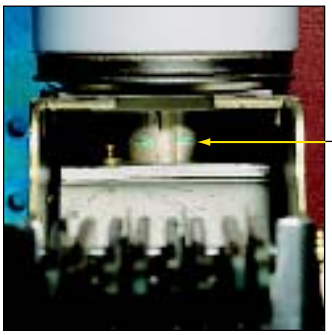
Type VCP-W Vacuum Circuit Breakers are easily maintained. The easy access mechanism and control components can be conveniently inspected and minor maintenance (such as lubricating the mechanism and replacing control components) is uncomplicated.

A Standardized Line

Type VCP-W Vacuum Circuit Breakers represent a standard line that utilizes common parts. Standardization provides for fewer total parts which, in turn, reduces and simplifies the spare parts inventory. Type VCP-W Vacuum Circuit Breakers of the same ratings are totally interchangeable between structures.

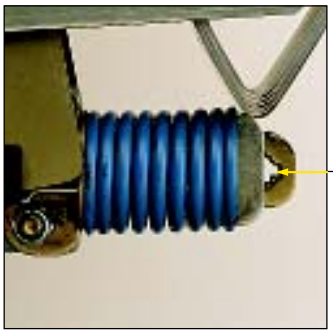
Stored energy mechanism is conveniently located behind the removable front panel. The front mounting of the mechanism provides two dead front shields between the operator and high voltage when the circuit breaker is energized.

Simplified Maintenance through Visual Inspection of Indicators



Easy-to-See Contact Erosion Indicator

The vacuum interrupter direct reading contact erosion indicator is clearly visible. Only periodic inspection of the erosion indicator is required.



Convenient Loading Spring Indicator

Visual inspection of the "T" cutout loading spring indicator insures that when closing the breaker, the loading springs are applying proper pressure to the contacts.

No More than You Want…
No Less than You Need

A Modular Value-Added Approach to Circuit Protection…Exclusively from Cutler-Hammer

	26-Inch Narrow Design	36-Inch Standard Design
5/15 kV Power Modules *Provide OEMs with a Complete Structure* UL Recognized		
5/15 kV Mini Modules *Provide OEMs with a More Value-Added Approach* UL Recognized		
5/15 kV Circuit Breaker Compartment Kits *Provide OEMs with the Opportunity to Add the Most Value* UL Recognized		
5/15 kV Vacuum Circuit Breakers Listed option is available	 *Type VCPW-ND*	 *Type VCP-W / VCP-WC*
	 Type VCP-WG	 *Type VCPW-SE*

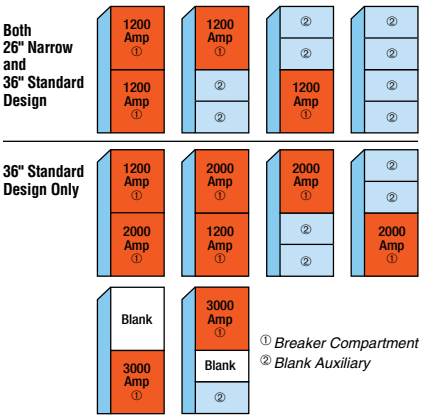
Power modules are ideal for OEMs who supply standard through complex switchgear. The OEM provides value-added items such as doors, bus, cable area compartments, instruments, relays and associated wiring. The power module incorporates individual vertical sections which will enclose a maximum of two Type VCP-W Circuit Breakers or four auxiliary drawers or a combination of one Type VCP-W Circuit Breaker and two auxiliary drawers.

- A complete structure including fully equipped circuit breaker and blank auxiliary compartment, control compartment, and main bus compartment…plus side and back sheets, roof assembly, door hinges/stops, and ventilation chimney.
- 36 inch wide design available in 10 configurations.
- 26 inch wide narrow design available in four configurations.
- The breaker can be inserted in the upper or lower compartment.
- Two auxiliary drawers (for PTs, CPT, or fuses) can be located in the upper or lower blank auxiliary compartment.
- Auxiliary compartment kits can be easily installed into any blank auxiliary power module compartment to suit any PT, CPT, or fuse drawer.
- All blank auxiliary B-Planes are prepunched to accept a PT, CPT, or fuse drawer kit.
- Exclusive 3,000 ampere breaker in the upper compartment with a single auxiliary drawer in the lower compartment.
- 4000 ampere forced air cooled power modules are also available.
- Available with glass polyester or porcelain insulating tubes for either 41 kA, 50 kA, or 63 kA applications.

Power Module Ampere Ratings

26" Narrow Design	1200A
36" Standard Design	1200A, 2000A, 3000A

Available Configurations



A simple building block approach in which the OEM provides value-added items such as doors, bus, cable area compartment, side sheets, instruments, relays, and associated wiring. Easily configured to suit many applications. Mini modules are available as:

- 1200, 2000, or 3000 ampere breaker compartment designs.
- Different bus terminal configurations available for upper or lower compartments.
- Boxed frame, levering-in assembly, glass polyester or porcelain insulating tubes for either 41 kA, 50 kA, or 63 kA applications, current transformer barrier, and shutter assembly.

Mini Module Ampere Ratings

26" Narrow Design	1200A
36" Standard Design	1200A, 2000A, 3000A

Circuit breaker compartment kits provide a maximum value-added approach to building switchgear, combining maximum design flexibility with cost competitiveness. Each circuit breaker compartment kit includes:

- Slot and tab design that assures all critical breaker/structure interfaces are maintained, eliminating the potential distortion problems that can occur with conventional weld/bend designs.
- Breaker levering-in assembly with left and right drawer drawout rails.
- Primary disconnect supports (upper and lower).
- Current transformer barrier assembly.
- Shutter assembly.
- Glass polyester or porcelain insulating tubes for either 41 kA, 50 kA, or 63 kA applications.
- Drawings that include dimensions and clearances are provided. B-Plane sheets are provided by the OEM to maximize a staged production process.

Compartment Kit Specifications

Ampere Rating	Primary Disconnect Supports	Stab Arrangements
26" Narrow Design		
1200A	Glass Polyester	Line and Load
36" Standard Design		
1200A	Glass Polyester or Porcelain	Line and Load or Line/Line Line and Load or Line/Line
2000A	Glass Polyester or Porcelain	Line and Load or Line/Line Line and Load or Line/Line
3000A	Glass Polyester or Porcelain	Line and Load Line and Load

Type VCPW-ND Medium Voltage Vacuum Circuit Breaker

The Type VCPW-ND Circuit Breaker offers proven industry leading vacuum circuit breaker technology in a 26 inch wide switchgear design, making it ideal for use when the benefits of a vacuum breaker are required and installation space is limited. The breaker is ANSI rated at 5 kV and IEC rated at 3.6/7.2 kV.*

Type VCP-W / VCP-WC / VCP-WG Medium Voltage Vacuum Circuit Breaker

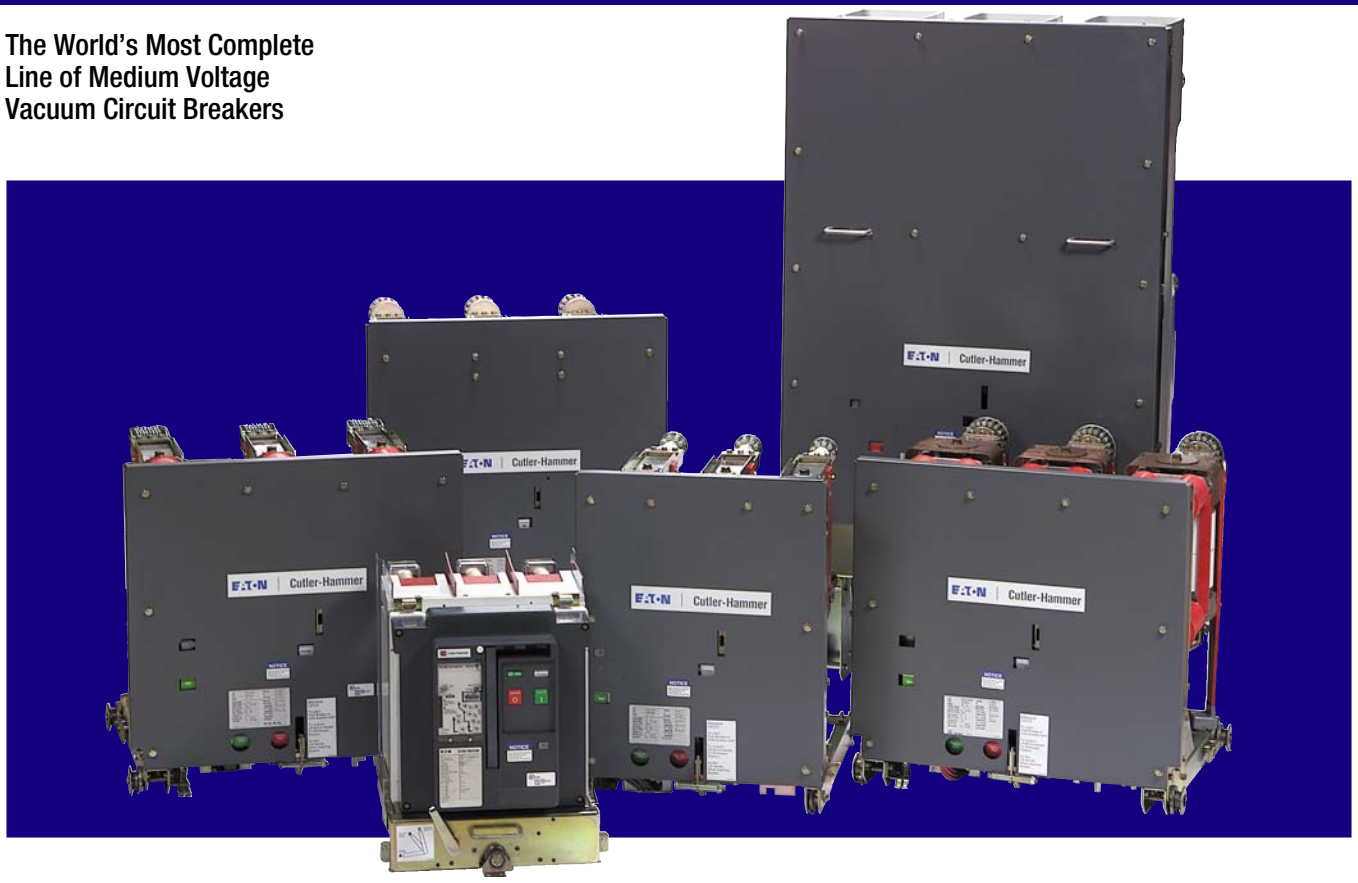
As with all Cutler-Hammer vacuum circuit breakers, reliability of the standard design Type VCP-W Vacuum Circuit Breaker has been proven by over 25 years of vacuum circuit breaker design and manufacturing experience. The breaker is designed for 36 inch wide switchgear and is ANSI rated at 5/15 kV and IEC rated at 3.6/17.5 kV.*

Type VCPW-SE Medium Voltage Vacuum Circuit Breaker

The Type VCPW-SE Vacuum Circuit Breaker is designed for 36 inch wide switchgear applications and includes cycloaliphatic epoxy insulation and cross linked polyolefin insulated control wire, making it ideal for use in harsh industrial environments. The breaker is ANSI rated at 5/15 kV, and IEC rated at 3.6/17.5 kV.*

** Refer to page 11 for specific breaker ratings. UL listing, 3-cycle ratings, undervoltage release, and second shunt trip are optionally available.*

The World's Most Complete Line of Medium Voltage Vacuum Circuit Breakers



Breaker Type	Voltage Class	Insulation BIL	Interrupting Ratings	Continuous Current	Application
VCPW-ND	ANSI 5 kV	60 kV	250 MVA	1200A	26" Wide New Metal-Clad Switchgear or Upgrades to Existing Airbreak Switchgear
	IEC 3.6-7.2 kV	40-60 kV	25-31.5 kA	630-1250A	
VCP-W	ANSI 5-15 kV	60-95 kV	250-1500 MVA	1200-3000A	36" Wide New Metal-Clad Switchgear or Upgrades to Existing Switchgear
	IEC 3.6-17.5 kV	40-95 kV	25-40 kA	630-2000A	
VCPW-SE	ANSI 5-15 kV	60-95 kV	250-1500 MVA	1200-3000A	36" Wide Special Environment Metal-Clad Switchgear Featuring Breakers with Cycloaliphatic Epoxy Insulation for Harsh Industrial Environments
	IEC 3.6-17.5 kV	40-95 kV	25-40 kA	630-2000A	
VCP-W	ANSI 27 kV	125 kV	16-40 kA	600-2000A	36" Wide Metal-Clad Switchgear or Upgrades to Existing Switchgear
	IEC 24 kV	125 kV	16-25 kA	630-2000A	
VCP-W	ANSI 38 kV	170 kV	16-40 kA, 1500 MVA	600-2500A	42" Wide Metal-Clad Switchgear
VCP-W (Outdoor)	ANSI 15.5 kV	110 kV	16-31.5 kA	600-1200A	Outdoor Station Distribution Breakers
W-VAC	IEC 3.6-17.5 kV	40-95 kV	16-40 kA	630-2000A	600-750 mm Wide IEC Medium Voltage Switchgear
W-VAC	IEC 3.6-17.5 kV	40-95 kV	31.5-50 kA	2500-3150A	1000 mm Wide IEC Medium Voltage Switchgear
W-VAC	IEC 36 kV	170 kV	16-31.5 kA	630-2000A	42" Wide IEC Metal-Clad Switchgear
DHP-VR	ANSI 5-15 kV	60-95 kV	250-1000 MVA	1200-3000A	DHP Metal-Clad Switchgear Technology Upgrades with the DHP-VR Direct Roll-in Vacuum Replacement Breakers from the Original Manufacturer
VCP-WR Series 18, 20, and 29	ANSI 5-15 kV	60-95 kV	250-1500 MVA	1200-3000A	Modular Fixed Vacuum Circuit Breakers in 18", 20", and 29" Widths for Conversions/Retrofits, Metal Enclosed Switchgear and Mining Switchgear
VCP-WC	ANSI 5-17.5kV	95kV	25-63kA	1200-3000A	36" wide Metal-Clad Switchgear
VCP-WG	ANSI 5-15kV	95kV	50-63kA	1200-3000A	36" wide Metal-Clad Switchgear
VCP-T	ANSI 5-15kV	95kV	16-25kA	800-1200A	Smaller frame breaker
VCP-TR	IEC 3.6-17.5kV	95kV	16-25kA	630-1250A	Smaller frame breaker

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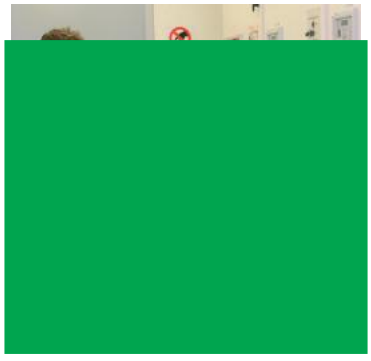


60-800
Single Section, 600V, 1200A max. (MCCB)
800A max. (QMQB)

60-100
Multisection, 600V, 1200A max.

60-400
Multisection, 600V, 6000A max.

Service Entrance Switchboard	Main Device	Distribution Device	Max. Voltage	Max. Amperage	Page No.
60-800	MCCB QMQB	MCCB QMQB	600V	1200A	K-3
60-100	MCCB QMQB	MCCB QMQB Sub-Metering	600V	1200A	K-4
60-400	MCCB Masterpact Bolt-Loc Power-Lok	MCCB QMQB Sub-Metering	600V	6000A	K-6

Ordering Information

1. Order main and distribution sections from pages 3-7.
   - 60-800 ..... p. 3
   - 60-100 ..... p. 4-5
   - 60-400 ..... p. 6-7
2. Order main device from pages 8-10
   - 60-800 ..... p. 8
   - 60-100 ..... p. 9
   - 60-400 ..... p. 10
3. Order branch device from pages 12-16
   - Multi-pole MCCBs p.12-13
   - Single-pole MCCBs ..... p. 14
   - QMQB Switches ..... p. 14
   - MQS Sub-metering ..... p. 14
   - NB Breakers ..... p. 16
4. Order metering device from p. 17
5. Order accessories from p. 19

Service Entrance Switchboards

Service Entrance Switchboards typically comprise three basic units: the Main device unit or cell, the utility compartment and the distribution section(s). Federal Pioneer offers a line of pre-engineered switchboards with main device ratings up to 6000A manufactured in accordance with CSA spec. C22.2 No. 31.

Application

- Federal Pioneer switchboards are designed for use in small and medium industrial and commercial building installations. Standard configurations, as described in the following pages, are ideally suited for these applications. Custom built designs are also available for special applications.

Main Device Compartment

- This section of the switchboard houses the main circuit breaker or fusible disconnect. Optional ground fault protection is available with the main device in most cases.

Utility CT and PT compartment

- The utility compartment contains the connectors and hardware needed for field-installation of the utility metering potential and current transformers. The universal design of this compartment allows mounting of both bar-type or windows-type CT's. However, windows type CT's are included as standard on 60-400 unless otherwise specified.

Distribution Section

- The distribution section houses the feeder devices. Federal Pioneer offers three types of feeder modules:
- the breaker module accepts MCCB's only
- the QMQB module accepts fusible disconnects
- sub-metering modules accept MQS units up to 200A.

Cable Entry

- A variety of cable entry options are available to accommodate most methods of cable entry. These include cabling directly to the main device, full length wireways, rear-entry bus stubs and other specific local utility requirements.

Auxiliary Metering and Protection

- Customer metering and indication, ground fault and other additional protection are available options with most types of switchboards.

Bus Bars

- Federal Pioneer offers tin plated aluminum bus as a standard with optional copper bus.

Shipping Splits

- The standard shipping split is a single cell configuration for units ordered from the modular selection chart. The main cell with wireway is considered as one section in this case.

Symbols

- Listed below are the symbols used in the module selection process.

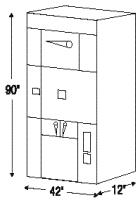
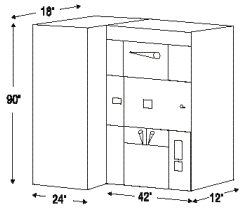
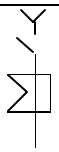
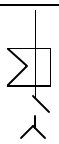
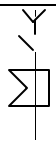
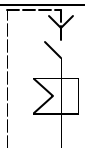
	Fixed Mounted Circuit Breaker
	Fusible Switch (Provision for Fuses)
	Utility Transformer Section
	Provision for Cable Entry(arrow points in direction cable is from)
	Bus Stub
	Electrical Connections
	Horizontal Bus at Top, bottom, Centre

60-800 Series

(Maximum 600 Volts, 1200 Amps)

Features

- 1200A maximum bus design
- Aluminum bus with tin plating standard; copper bus optional
- Main devices are MCCB (400-1200A) and QMQB (400-800A)
- 42 "X" feeder device space available (28 7/8").
- NB type branch breakers available
- Split neutral design makes distribution wiring easier
- Continuous ground bus
- Galvanized steel construction. Front covers painted ASA61 grey
- CSA Type 1 Enclosure Standard
- Floor mounted, wall supported
- Single section main, distribution and utility service
- Compact 12" depth
- CSA C22.2, No. 31 approved

60-800 Main Cell (Prices Do Not Include Main Device)		Box Diagram				
		Single Line Diagram				
Main Device	**Amps**		**Top**	**Bottom**	**Right**	**Left**
MCCB	400	Catalogue No.	60800-6A-T	60800-6A-B	60800-6A-WJLR	60800-6A-WJLL
		List Price ‡				
	600	Catalogue No.	60800-6A-T	60800-6A-B	60800-6A-WJMR	60800-6A-WJML
		List Price ‡				
	800	Catalogue No.	60800-6A-T	60800-6A-B	60800-6A-WCMHR	60800-6A-WCMHL
		List Price ‡				
	1000	Catalogue No.	60800-6A-T	60800-6A-B	60800-6A-WCMHR	60800-6A-WCMHL
		List Price ‡				
	1200	Catalogue No.	—	—	60812-6A-WCKR	60812-6A-WCKL
		List Price ‡				
Fusible	400, 600	Catalogue No.	60800-6A-T	60800-6A-B	60800-6A-WQ6R	60800-6A-WQ6L
		List Price ‡				
	800	Catalogue No.	60800-6A-T	60800-6A-B	60800-6A-WQ8R	60800-6A-WQ8L
		List Price ‡				

Note: See page K-8 for main devices.

Distribution Section

Branch Device	Max Branch Unit	Available Branch Height
MCCB	1000A	42X
Fusible Switches	400A	42X

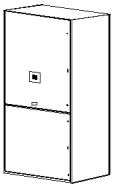
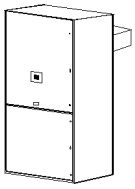
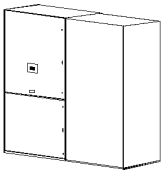
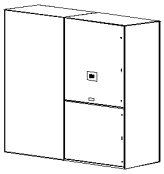
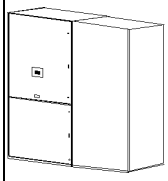
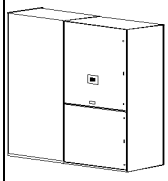
1. Branch devices 225A and less may exit through the top, bottom or sides. Branch devices 400-1000A may exit through the end opposite to the CT compartment barrier.
2. Select branch devices from pages K-11 to 15.

60-100 Series

(Maximum 600 Volts, 1200 Amps)

Features

- 1200A maximum bus design
- Aluminum bus with tin plating standard; copper bus optional
- Main devices are MCCB circuit breakers or QMQB fusible load break switches
- NB type branch breakers available
- Sub-metering branch devices available up to 200A
- Free standing, cable fed distribution section available
- Capable of bus duct entry or exit
- Galvanized steel construction with ASA 61 grey steel front covers
- CSA Type 1 Enclosure Standard
- Floor mounted, free standing
- Front accessible
- CSA C22.2, No. 31 approved

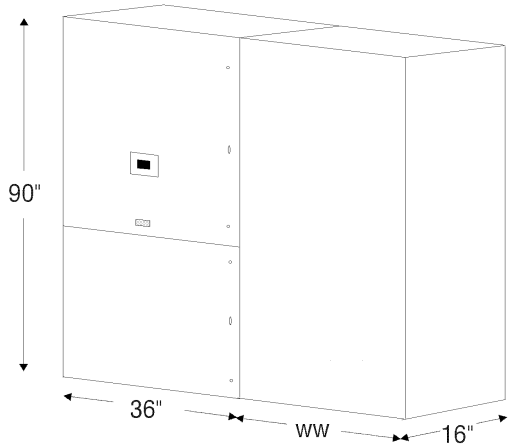
60-100Main Section (Prices Do Not Include Main Device)		Box Diagram	 Top Entry	 Bus Stub	 Right Wireway	 Left Wireway	 Right Busless Wireway	 Left Busless Wireway
		Single Line Diagram						
Main Device		**Amps**	**List Price ‡**					
MCCB		400A						
		600A						
		800A						
		1000A						
		1200A						
QMQB		400A						
		600A						
		800A						
		1000A						
		1200A						

Notes:

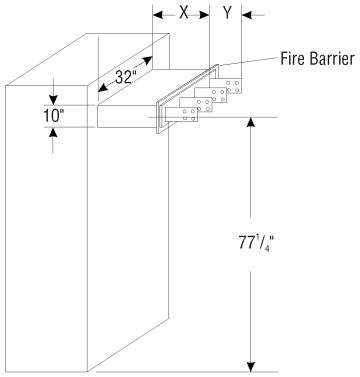
1. See page K-9 for main devices.
2. Wireway bottom entry only.
3. Stand alone main cell requires wireway for exit.

60-100 Main Cell

Dimensional Information



Busless wireway width (ww) is 16", bussed wireway width (ww)is 24".



Bus Stub (Back View)

Notes:

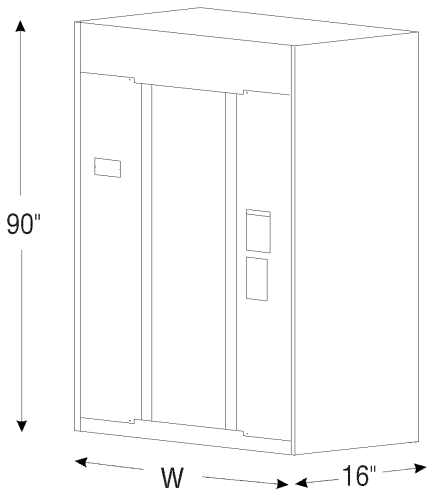
1. For 6" wall, X = 5"; 8" wall, X = 9.5"; 12" wall, X = 13.5". If other than standard is required, please consult factory.
2. Y dimension and hole patterns as per local hydro requirements.

60-100 Distribution Cell

60-100 Distribution	Single Line Diagram	To line up with main	Free Standing Distribution	
			Distribution	Wireway 1
Branch Device	**Amps**	**List Price ‡**		
MCCB Fusible Switches Sub-metering MQS	400A			
	600A			
	800A			
	1000A			
	1200A			

Notes:

1. Wireway dimensions are 16"W x 16"D x 90"H.
2. Select branch breakers from pages K-12 to 16.



Distribution Cell Dimensions

Branch Device	Width (W)	Device Types	Available Device Height
MCCB	38"	FK, CE, CJL, CJM, CMH, TH1, TH4	96X
	42"	CK, TH8	
Fusible	38"	30-600A QMQB	98X
	42"	800A QMQB	
Sub-Metering MQS	45"	30-200A MQS	98X1

Note:

1. Some utilities may limit available MQS height to 70X.

60-400 Series

(Maximum 600 volts, 6000 Amps)

Features

- 6000A maximum bus design
- Aluminum bus with tin plating standard; copper bus optional
- Main devices include Masterpact Circuit Breaker, MCCB's or Power-Lok/Bolt-Lok switches
- NB type branch breakers available
- Sub-metering distribution available to 200A
- Free standing, cable fed distribution section available
- Bottom Entry Mains available w/o wireway (except w/Power-Lok Main)
- Capable of bus duct entry
- Exterior finish painted ASA 61 grey
- CSA Type 1 indoor enclosure standard
- Floor mounted, free standing
- Channel base supplied as standard
- A wide variety of options are available to meet customer requirements
- CSA C22.2, No. 31 approved

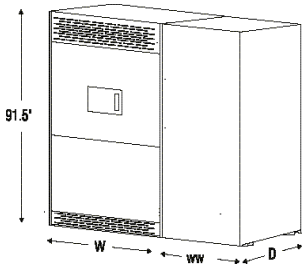
60-400 Main Section (Prices Do Not Include Main Device)			Top entry	Bottom Entry	Bus Stub	Right Wireway	Left Wireway
Main Devices		**Amps**	**List Price ‡**				
Breakers		1600A					
		2000A					
		2500A					
		3000A					
		4000A					
		5000A	Consult Factory				
Fusible		1600A					
		2000A					
		2500A					
		3000A					
		4000A[3]					
		5000A[3]	Consult Factory				
		6000A	Consult Factory				

Notes:

1. 4000, 5000A and 6000A available in copper bus only.
2. See page K-10 for main devices.
3. Wireway required for bottom entry if using Power-Lok Fusible main.
4. Stand-alone main cell requires wireway for exit.

60-400 Main Cell

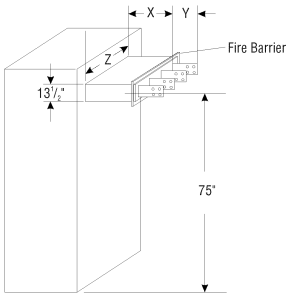
Dimensional Information



Height includes channel base

Main Cell Dimensions (in)

Amps	Main Device	W	D	ww
1600	CPH, PE, PX	36	24	24
	Bolt Loc			
2000	CPH, PE, PX			
	Bolt Loc			
2500	PE, PX	36	24	36
	Bolt Loc	42		
3000	Masterpact	42	36	36
	Bolt Loc			
4000	Masterpact	48	48	36
	Power Lok			
5000	Masterpact	48	54/60	42
6000	Masterpact	54	60	42



Bus Stub (Back View)

Notes:

1. For 6", X = 7.25; 8" wall, X = 9.25"; 12" wall, X = 13.25".
   If other than standard is required, please consult factory.
2. Y dimensions and hole pattern as per local hydro requirements.
3. Z = Main cell width - 2.5".

60-400 Distribution Cell

60-400 Distribution	Single Line Diagram	To line up with main	Wireway Adder[2]
Branch Device	**Main Bus Amps**	**List Price**	
MCCB Fusible Switches Sub-metering MQS	1600A		
	2000A		
	2500A		
	3000A		
	4000A[1]		
	5000A[1]	Consult Factory	
	6000A	Consult Factory	

Notes:

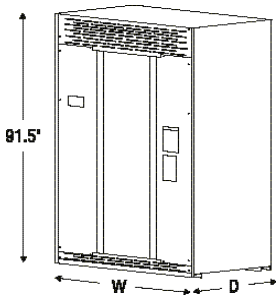
1. 4000A/5000A/6000A Copper Bus Only.
2. Wireway required for free-standing distribution.
   Consult factory if deeper cell is more suitable than wireway.
3. Select branch breakers from pages K-12 to 16.

Distribution Cell Dimensions

Branch Device	Device Types	Width (W)	Depth (D)	Available Device Height
MCCB	FK, CE, CJL, CMH, TH1, TH4, TH8, CK	42"	24"	104X
			36"	
			48"	
Fusible Switches	30-1200A QMQB	42"	24"	106X
			36"	
			48"	
MQS	30-200A MQS	48"	24"	98X[2]
			36"	
			48"	

Notes:

1. Using a 1200A QMQB in the distribution section takes up additional X space. If top exit, remaining space is 52X. If bottom exit, remaining space is 34X. Only one 1200A QMQB per distribution section.
2. Some utilities may limit available MQS height to 70X.



60-800 Main Devices

Moulded Case Circuit Breakers

Amps	Trip Unit	Catalogue Number	List Price ‡
400	Thermal-Magnetic	CJL3400E	
	Thermal-Magnetic	CJL3400N	
	Thermal-Magnetic	CJL3400H	
	Thermal-Magnetic	CMH36400	
	Electronic	CK3400E-4S	
	Elec. w/ Gr. Flt.	CK3400E-4UT	
	100% Electronic	CK3400EE-4S	
	100% Elec. w/ Gr. Flt.	CK3400EE-4UT	
	Electronic	CK3400N-4S	
	Elec. w/ Gr. Flt.	CK3400N-4UT	
	100% Electronic	CK3400NN-4S	
	100% Elec. w/ Gr. Flt.	CK3400NN-4UT	
	Electronic	CK3400H-4S	
	Elec. w/ Gr. Flt.	CK3400H-4UT	
	100% Electronic	CK3400HH-4S	
	100% Elec. w/ Gr. Flt.	CK3400HH-4UT	
600	Thermal-Magnetic	CMH36600	
	Thermal-Magnetic	CJM3600E	
	Thermal-Magnetic	CJM3600N	
	Thermal-Magnetic	CJM3600H	
	Electronic	CK3600E-8S	
	Elec. w/ Gr. Flt.	CK3600E-8UT	
	100% Electronic	CK3600EE-8S	
	100% Elec. w/ Gr. Flt.	CK3600EE-8UT	
	Electronic	CK3600N-8S	
	Elec. w/ Gr. Flt.	CK3600N-8UT	
	100% Electronic	CK3600NN-8S	
	100% Elec. w/ Gr. Flt.	CK3600NN-8UT	
	Electronic	CK3600H-8S	
	Elec. w/ Gr. Flt.	CK3600H-8UT	
	100% Electronic	CK3600HH-8S	
	100% Elec. w/ Gr. Flt.	CK3600HH-8UT	
800	Thermal-Magnetic	CMH36800	
	Electronic Trip	CK3800E-8S	
	Elec. w/ Gr. Flt.	CK3800E-8UT	
	100% Electronic	CK3800EE-8S	
	100% Elec. w/ Gr. Flt.	CK3800EE-8UT	
	Electronic	CK3800N-8S	
	Elec. w/ Gr. Flt.	CK3800N-8UT	
	100% Electronic	CK3800NN-8S	
	100% Elec. w/ Gr. Flt.	CK3800NN-8UT	
	Electronic	CK3800H-8S	
	Elec. w/ Gr. Flt.	CK3800H-8UT	
	100% Electronic	CK3800HH-8S	
	100% Elec. w/ Gr. Flt.	CK3800HH-8UT	
1000	Thermal-Magnetic	CMH361000	
	Electronic	CK31000E-12S	
	Elec. w/ Gr. Flt.	CK31000E-12UT	
	Electronic	CK31000N-12S	
	Elec. w/ Gr. Flt.	CK31000N-12UT	
	Electronic	CK31000H-12S	
	Elec. w/ Gr. Flt.	CK31000H-12UT	
1200	Electronic	CK31200E-12S	
	Elec. w/ Gr. Flt.	CK31200E-12UT	
	Electronic	CK31200N-12S	
	Elec. w/ Gr. Flt.	CK31200N-12UT	
	Electronic	CK31200H-12S	
	Elec. w/ Gr. Flt.	CK31200H-12UT	

Note:

1. CJL and CJM breakers have optional electronic trips,see pages 11-12 for prices.

Fusible Switches

Amps	Type	Catalogue Number	List Price ‡
400	QMQB	QMQB4836B	
600		QMQB7036B	
800		QMQB8836B	

Note:

1. For fuses see Section E.

CJL

CMH

60-100 Main Devices

Moulded Case Circuit Breakers

Amps	Trip Unit	Catalogue Number	List Price ‡
400	Thermal-Magnetic	CMH36400	
	Thermal-Magnetic	CJM3400E	
	Thermal-Magnetic	CJM3400N	
	Thermal-Magnetic	CJM3400H	
	Electronic	CK3400E-4S	
	Elec. w/ Gr. Flt.	CK3400E-4UT	
	100% Electronic	CK3400EE-4S	
	100% Elec. w/ Gr. Flt.	CK3400EE-4UT	
	Electronic Trip	CK3400N-4S	
	Elec. w/ Gr. Flt.	CK3400N-4UT	
	100% Electronic	CK3400NN-4S	
	100% Elec. w/ Gr. Flt.	CK3400NN-4UT	
	Electronic	CK3400H-4S	
	Elec. w/ Gr. Flt.	CK3400H-4UT	
	100% Electronic	CK3400HH-4S	
	100% Elec. w/ Gr. Flt.	CK3400HH-4UT	
600	Thermal-Magnetic	CMH36600	
	Thermal-Magnetic	CJM3600E	
	Thermal-Magnetic	CJM3600N	
	Thermal-Magnetic	CJM3600H	
	Electronic	CK3600E-8S	
	Elec. w/ Gr. Flt.	CK3600E-8UT	
	100% Electronic	CK3600EE-8S	
	100% Elec. w/ Gr. Flt.	CK3600EE-8UT	
	Electronic	CK3600N-8S	
	Elec. w/ Gr. Flt.	CK3600N-8UT	
	100% Electronic	CK3600NN-8S	
	100% Elec. w/ Gr. Flt.	CK3600NN-8UT	
	Electronic	CK3600H-8S	
	Elec. w/ Gr. Flt.	CK3600H-8UT	
	100% Electronic Trip	CK3600HH-8S	
	100% Elec. w/ Gr. Flt.	CK3600HH-8UT	
800	Thermal-Magnetic	CMH36800	
	Electronic	CK3800E-8S	
	Elec. w/ Gr. Flt.	CK3800E-8UT	
	100% Electronic	CK3800EE-8S	
	100% Elec. w/ Gr. Flt.	CK3800EE-8UT	
	Electronic	CK3800N-8S	
	Elec. w/ Gr. Flt.	CK3800N-8UT	
	100% Electronic	CK3800NN-8S	
	100% Elec. w/ Gr. Flt.	CK3800NN-8UT	
	Electronic	CK3800H-8S	
	Elec. w/ Gr. Flt.	CK3800H-8UT	
	100% Electronic	CK3800HH-8S	
	100% Elec. w/ Gr. Flt.	CK3800HH-8UT	
1000	Thermal-Magnetic	CMH361000	
	Electronic	CK31000E-12S	
	Elec. w/ Gr. Flt.	CK31000E-12UT	
	100% Electronic	CK31000EE-12S	
	100% Elec. w/ Gr. Flt.	CK31000EE-12UT	
	Electronic	CK31000N-12S	
	Elec. w/ Gr. Flt.	CK31000N-12UT	
	100% Electronic	CK31000NN-12S	
	100% Elec. w/ Gr. Flt.	CK31000NN-12UT	
	Electronic	CK31000H-12S	
	Elec. w/ Gr. Flt.	CK31000H-12UT	
	100% Electronic	CK31000HH-12S	
	100% Elec. w/ Gr. Flt.	CK31000HH-12UT	

Amps	Type	Catalogue Number	List Price ‡
1200	Thermal-Magnetic	CPH2036	
	Electronic	PXF361200	
	Elec. w/ Gr. Flt.	PXF361200G	
	100% Electronic	PEF361200LI	
	100 % Elec. w/ Gr. Flt.	PEF361200LIG	
	100% Electronic	PEF361200LS	
	100 % Elec. w/ Gr. Flt.	PEF361200LSG	
	Electronic	CK31200E-12S	
	Elec. w/ Gr. Flt.	CK31200E-12UT	
	100% Electronic	CK31200EE-12S	
	100% Elec. w/ Gr. Flt.	CK31200EE-12UT	
	Electronic	CK31200N-12S	
	Elec. w/ Gr. Flt.	CK31200N-12UT	
	100% Electronic	CK31200NN-12S	
	100% Elec. w/ Gr. Flt.	CK31200NN-12UT	
	Electronic	CK31200H-12S	
	Elec. w/ Gr. Flt.	CK31200H-12UT	
	100% Electronic	CK31200HH-12S	
	100% Elec. w/ Gr. Flt.	CK31200HH-12UT	

Fusible Switches

Amps	Type	Catalogue Number	List Price‡
400	QMQB	QMQB4836B	
600		QMQB7036B	
800		QMQB8836B	
1200		QMQB9836B	
1200	QMQB w/ Gr. Flt.	—	

Note:

1. For fuses see Section E.

CMH

CK

60-400 Main Devices

Moulded Case Circuit Breakers

Amps	Trip Unit	Catalogue Number	List Price ‡
1600	Thermal-Magnetic	CPH2036	
	Electronic	PXF361600	
	Elec. w/ Gr. Flt.	PXF361600G	
	100% Electronic	PEF361600LI	
	100 % Elec. w/ Gr. Flt.	PEF361600LIG	
	100% Electronic	PEF361600LS	
	100 % Elec. w/ Gr. Flt.	PEF361600LSG	
2000	Thermal-Magnetic	CPH2036	
	Electronic	PXF362000	
	Elec. w/ Gr. Flt.	PXF362000G	
	100% Electronic	PEF362000LI	
	100 % Elec. w/ Gr. Flt.	PEF362000LIG	
	100% Electronic	PEF362000LS	
	100 % Elec. w/ Gr. Flt.	PEF362000LSG	
2500	Electronic	PXF362500	
	Elec. w/ Gr. Flt.	PXF362500G	
	100% Electronic	PEF362500LI	
	100 % Elec. w/ Gr. Flt.	PEF362500LIG	
	100% Electronic	PEF362500LS	
	100 % Elec. w/ Gr. Flt.	PEF362500LSG	

Interrupting Capacity

Amperes	Main Device	Interrupting Capacity (kA) @600 Vac
1600	CPH	65
	PE	65
	PX	65
	Masterpact	65
	Bolt-Loc	200
2000	CPH	65
	PE	65
	PX	65
	Masterpact	75
	Bolt-Loc	200
2500	PE	65
	PX	65
	Bolt-Loc	200
3000	MasterPact	75
	Bolt-Loc	200
4000	MasterPact	75
	Power-Lok	200
5000	MasterPact	100

Note:

1. Bolt-Loc and Power-Lok interrupting capacities are 200 kA when used with fuses.
2. Consult Schneider Canada for unfused I.C. ratings.

Insulated Case Circuit Breakers

Amps	Type	Cat. No.	List Price ‡
1600	Masterpact	M16H1	
2000		M20H1	
3000		M30H1	
4000		MP40H1	
5000		MP50H1	
6000		MP60H1	

Note:

1. Electronic Trip, 100% rated, includes ground-fault protection.

Fusible Switches

Amps	Type	List Price ‡
1600	Bolt-Loc	
	Bolt-Loc w/ Gr. Flt.	
2000	Bolt-Loc	
	Bolt-Loc w/ Gr. Flt.	
2500	Bolt-Loc	
	Bolt-Loc w/ Gr. Flt.	
3000	Bolt-Loc	
	Bolt-Loc w/ Gr. Flt.	
4000	Power-Lok	
	Power-Lok w/ Gr. Flt.	

Masterpact

PX

Main Device Accessories

For CJL, CJM, CMH and CK accessories, see section I.

CPH, PE, PX

Accessory	List Price ‡
Alarm Switch	
Auxiliary Switch 1A/1B 2A/2B 3A/3B	
Local Ammeter	
Local Trip Indicator	
Key Interlock	
Neutral Current Transformer (except CPH)	
Shunt Trip	
Time Delay Unit	
Undervoltage Release	

QMQB

Accessory	List Price ‡
Shunt Trip	

(1200A QMQB Only)

MasterPact

Accessory	List Price ‡
Shunt Trip	
Undervoltage Release	
Time Delay Unit	
Zone Interlock	
Door Interlock	
Key Interlock	

Power-Lok and Bolt-Loc

Accessories	List Price ‡
Blown Fuse Detector	
Key Interlock	

Switchboard Branch Devices, Multi-pole MCCB's

Type	Amps	Poles	Interrupting Capacity				Mounting	Branch Height	List Price ‡
			240 Vac	480 Vac	600 Vac	250 Vdc			
FKD	100-250A	2	25 kA	-	-	-	DOUBLE	3X	
		3							
FKG	100-250A	2	65 kA	-	-	-	DOUBLE	3X	
		3							
CE..E4	15-60A	2	18 kA	14 kA	-	10 kA	DOUBLE	2X	
	70-100A								
	15-60A	3	18 kA	14 kA	-	10 kA	DOUBLE	3X	
	70-100A								
CE..B	15-60A	2	18 kA	14 kA	14 kA	10 kA	DOUBLE	2X	
	70-100A								
	125-150A								
	175-225A								
	15-60A	3	18 kA	14 kA	14 kA	10 kA	DOUBLE	3X	
	70-100A								
	125-150A								
	175-225A								
CE..E	15-60A	2	65 kA	25 kA	18 kA	10 kA	DOUBLE	2X	
	70-100A								
	125-150A								
	175-225A								
	15-60A	3	65 kA	25 kA	18 kA	10 kA	DOUBLE	3X	
	70-100A								
	125-150A								
	175-225A								
CE..N	15-60A	2	100 kA	65 kA	25 kA	22 kA	DOUBLE	2X	
	70-100A								
	125-150A								
	175-225A								
	15-60A	3	100 kA	65 kA	25 kA	22 kA	DOUBLE	3X	
	70-100A								
	125-150A								
	175-225A								
CE..H	15-60A	2	200 kA	100 kA	35 kA	22 kA	DOUBLE	2X	
	70-100A								
	125-150A								
	175-225A								
	15-60A	3	200 kA	100 kA	35 kA	22 kA	DOUBLE	3X	
	70-100A								
	125-150A								
	175-225A								
CJL250E	100-250A	3	65 kA	35 kA	25 kA	10 kA	DOUBLE	4X	
CJL250E-T									
CJL250E-TA									
CJL250E-TG									
CJL250E-TAG									
CJL250N	100-250A	3	100 kA	65 kA	35 kA	22 kA	DOUBLE	4X	
CJL250N-T									
CJL250N-TA									
CJL250N-TG									
CJL250N-TAG									
CJL250H	100-250A	3	200 kA	100 kA	50 kA	22 kA	DOUBLE	4X	
CJL250H-T									
CJL250H-TA									
CJL250H-TG									
CJL250H-TAG									

Notes:

1. CJL and CJM are available with optional electronic trips (with suffix -T, -TA, -TG, -TAG, see section I for more information) .
2. Above prices include mounting hardware and installation.
3. For replacement branch breaker and mounting hardware prices, see Section I.

Switchboard Branch Devices, Multi-pole MCCB's (continued)

Type	Amps	Poles	Interrupting Capacity				Mounting	Branch Height	List Price ‡
			240 Vac	480 Vac	600 Vac	250 Vdc			
CJL400E	300-400A	3	65 kA	35 kA	25 kA	10 kA	DOUBLE	4X	
CJL400E-T									
CJL400E-TA									
CJL400E-TG									
CJL400E-TAG									
CJL400N	300-400A	3	100 kA	65 kA	35 kA	22 kA	DOUBLE	4X	
CJL400N-T									
CJL400N-TA									
CJL400N-TG									
CJL400N-TAG									
CJL400H	300-400A	3	200 kA	100 kA	50 kA	22 kA	DOUBLE	4X	
CJL400H-T									
CJL400H-TA									
CJL400H-TG									
CJL400H-TAG									
CJM..E	300-600A	3	65 kA	35 kA	25 kA	10 kA	SINGLE	12X	
CJM..E-T									
CJM..E-TA									
CJM..E-TG									
CJM..E-TAG									
CJM..N	300-600A	3	100 kA	65 kA	35 kA	22 kA	SINGLE	12X	
CJM..N-T									
CJM..N-TA									
CJM..N-TG									
CJM..N-TAG									
CJM..H	300-600A	3	200kA	100kA	50kA	22 kA	SINGLE	12X	
CJM..H-T									
CJM..H-TA									
CJM..H-TG									
CJM..H-TAG									
CMH	300-600A	3	65 kA	65 kA	25 kA	14 kA	SINGLE	16X	
	700-800A								
	900-1000A								
CK400E	200-400A	3	42 kA	35 kA	25 kA	-	SINGLE	12X	
CK400N			65 kA	50 kA	35 kA				
CK400H			100 kA	65 kA	42 kA				
CK800E	400-800A	3	42 kA	35 kA	25 kA	-	SINGLE	12X	
CK800N			65 kA	50 kA	35 kA				
CK800H			100 kA	65 kA	42 kA				
CK1200E	600-1200A	3	42 kA	35 kA	25 kA	-	SINGLE	12X	
CK1200N			65 kA	50 kA	35 kA				
CK1200H			100 kA	65 kA	42 kA				
TH1	15-100A	3	200 kA	200 kA	200 kA	100 kA	DOUBLE	6X	
TH4	70-225A	3	200 kA	200 kA	200 kA	100 kA	SINGLE	12X	
	250-400A								
TH8	300-600A	3	200 kA	200 kA	200 kA	100 kA	SINGLE	12X	
	700-800A								

Notes:

1. CK breakers have electronic trips only.
2. CJL and CJM are available with optional electronic trips (with suffix -T, -TA, -TG, -TAG, see section I for more information) .
3. For 100% rated CK breakers, add 15% to breaker price list. (800A max)
4. Above prices include mounting hardware and installation.
5. For replacement branch breaker and mounting hardware prices, see Section I.

Switchboard Branch Devices, Single Pole MCCBs

Poles	Lug Size	Interrupting Capacity			Catalogue No.	Type	List Price ‡
		347 Vac	277 Vac	120/240 Vac			
1	(1) #14 - #6 Cu/Al	14 kA	14kA	42 kA	HEW0015	Std. Single	
		14 kA	14 kA	42 kA	HEW0020	Std. Single	
		14 kA	14 kA	42 kA	HEW1515	Twin[2]	
		14 kA	14 kA	42 kA	HEW2020	Twin[2]	
		25 kA	65 kA	100 kA	HEZ0015	Std. Single	
		25 kA	65 kA	100 kA	HEZ0020	Std. Single	
		25 kA	65 kA	100 kA	HEZ1515	Twin[2]	
		25 kA	65 kA	100 kA	HEZ2020	Twin[2]	
	(1) #14 - 1/0 Cu/Al	18 kA	25 kA	25 kA	CE1015E	Std. Single	
		18 kA	25 kA	25 kA	CE1020E	Std. Single	
		18 kA	25 kA	25 kA	CE1030E	Std. Single	
		25 kA	65 kA	65 kA	CE1015N	Std. Single	
		25 kA	65 kA	65 kA	CE1020N	Std. Single	
		25 kA	65 kA	65 kA	CE1030N	Std. Single	

Notes:

1. Above prices include mounting hardware and installation.
2. Twin pole breaker has one common line connection and two separate load connections.

30A : 30A (TWIN)

200A (SINGLE)

Switchboard Branch Devices, QMQB Switches

Max. Volts	Amps	Catalogue Number	Maximum Wire Size	Branch Height	Fuse Type	Poles	List Price ‡
600 Vac 250 Vdc	30-30	QMQB3336B	(1) #6 Cu/Al	8X	J, T[3]	3	
	60-60	QMQB6636B	(1) #2 Cu/Al				
	100-100	QMQB1136B	(1) 1/0 Cu/Al				
	200	QMQB2036B	(1) 250 MCM Cu/Al	14X	H, R, J, T		
	400	QMQB4836B	(1) 750 MCM or (2) 500 MCM or (3) 300 MCM or (4) 3/0 Cu/Al	24X			
	600	QMQB7036B					
	800	QMQB8836B	(2) 750 MCM or (3) 500 MCM Cu/Al	28X	L,T		
	1200	QMQB9836B	(4) 750 MCM Cu/Al	54X			
	1200 c/w Shunt Trip	QMQB9836BS					

Notes:

1. Above prices include cost of installation. See page D-16 for replacement units.
2. Prices do not include fuses. See Section E for fuse prices.
3. 30A-100A units shipped in class J fuse configuration only. T-fuse kit available for 100A only.
4. 200A to 600A units are shipped in class J fuse configuration only. Please specify type of fuse required.
5. 800A and 1200A units are shipped in Class L configuration only. Please specify when Class T fuse is required.
6. 1200A Class T fuse available for 240V system only.

Switchboard Branch Devices, MQS Branch Utility Metering Switches

Max. Volts	Amps	Maximum Wire Size	Catalogue No.	Branch Height	Fuse Type	Poles	List Price ‡
600 Vac 250 Vdc	30-30	(1) #6 Cu/Al	MQS7-3336B	14X	J,T[2]	3	
	60-60	(1) #2 Cu/Al	MQS7-6636B				
	100-100	(1) 1/0 Cu/Al	MQS7-1136B				
	200	(1) 250 MCM Cu/Al	MQS7-2036				

Notes:

1. Utility meter not included.
2. T-fuse kit available for 100A and 200A only.

Switchboard Branch Devices, NB Breakers

Federal Pioneer Switchboards accept NB type branch circuit breakers. Two methods are available for mounting these breakers into a switchboard distribution section. The first method (interior method) utilizes the same interior as the NBLP or NBDP panelboard. The interior is mounted directly on the switchboard bus. This method restricts the sum of the amperage rating on each phase to 225A (for NBLP) and 400 or 600A (for NBDP). If more amperage per phase is required, there is another method available using a module kit. This method (modular method) allows the NB breakers to be mounted directly on the switchboard bus.

Interior Method - 240 Vac, 225A Max.

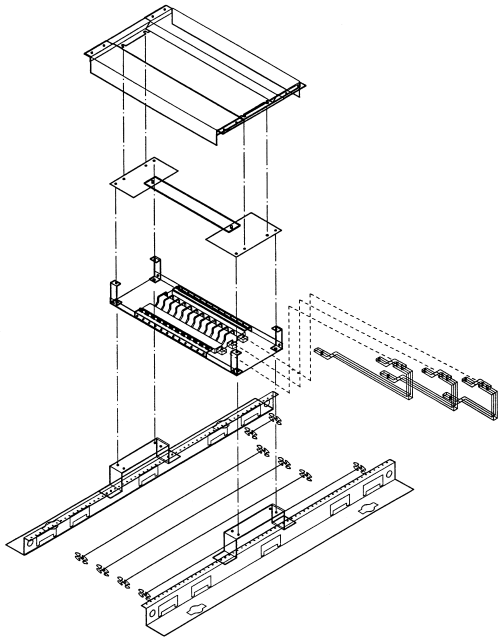
- Available in 60-800, 60-100 and 60-400.
- NBLP interior is mounted on switchboard bus.
- Single interiors mount horizontally. Double interiors mount side by side vertically.
- These interiors may be fed either from main breaker(s) or directly from switchboard bus.
- Choose main and branch breakers based on the maximum short circuit capacity of the system (22 kA Max, NBH).
- The sum of the rating of the NB/NBH breakers connected in the NBLP interior must not exceed 225A per phase.

NBLP Interiors (Price includes factory installation)

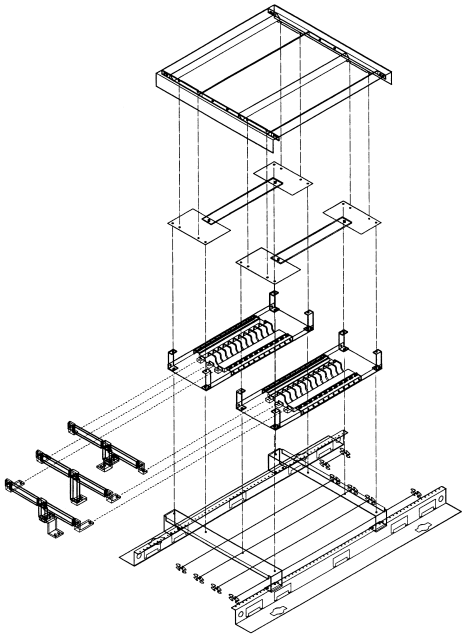
System	No. of Circuits	Main Bus	Single Interior (MLO 225A)			Double Interior (MLO 225A)		
			Catalog Number	X Space	List Price ‡	Catalog Number	X Space	List Price ‡
1P3W	24	Aluminum	NBLP-3AS	20X		NBLP-3AT	28X	
		Copper	NBLP-3CS			NBLP-3CT		
3P4W		Aluminum	NBLP-4AS			NBLP-4AT		
		Copper	NBLP-4CS			NBLP-4CT		

Notes:

1. If NBLP interior is fed from main breaker, the NB main breaker is mounted within the interior; CE and FK breakers are mounted separately.
2. Choose NB breakers from page K-16.



NBLP Single Interior



NBLP Double Interior

Interior Method - 240 Vac, 600A Max.

- Available in 60-100 and 60-400 only.
- NBDP interior is mounted directly on switchboard bus.
- These interiors may be fed either from main breaker(s) or directly from switchboard bus.
- Choose main and branch breakers based on the maximum short circuit capacity of the system (22 kA Max, NBH).
- The sum of the rating of the NB/NBH breakers connected per phase in the NBDP interior must not exceed 400 / 600A.

NBDP Interiors (Price includes factory installation)

System	No. of Circuits	X Space	Amps	Main Bus	Catalogue Number	List Price ‡
1P3W	42	48X	400A	Al	NBDP42S-1B400AS	
				Cu	NBDP42S-1B400CS	
			600A	Al	NBDP42S-1B600AS	
				Cu	NBDP42S-1B600CS	
	66	66X	400A	Al	NBDP66S-1B400AS	
				Cu	NBDP66S-1B400CS	
			600A	Al	NBDP66S-1B600AS	
				Cu	NBDP66S-1B600CS	
3P4W	42	48X	400A	Al	NBDP42S-4B400AS	
				Cu	NBDP42S-4B400CS	
			600A	Al	NBDP42S-4B600AS	
				Cu	NBDP42S-4B600CS	
	66	66X	400A	Al	NBDP66S-4B400AS	
				Cu	NBDP66S-4B400CS	
			600A	Al	NBDP66S-4B600AS	
				Cu	NBDP66S-4B600CS	

Note: Choose NB breakers from page K-16.

Modular Method - 240 Vac Max.

- Available in 60-800, 60-100 and 60-400.
- The NB breakers are connected directly on to the switchboard bus, in lieu of using a NBLP interior.
- The advantage of this method is that the sum of the rating of the NB breakers connected per phase is not restricted to 225A maximum.
- Available in 24 cct. modules only which require 22X spaces per module.
- Maximum NB branch is 100A.

NB Modules (Price includes factory installation)

System	No. of Circuits	X Space	Catalogue Number	List Price ‡
1Ø3W	24	22X	NBLP-MOD	
3Ø4W				

Note: Choose NB breakers from page K-16.

Switchboard Branch Devices, NB Breakers (cont'd)

NB Breakers

NB	10 kA @ 120 / 240V				NBH	22 kA @ 120 / 240V			
Poles	Amps	Cat. No.	Wire Range	List Price ‡	Poles	Amps	Cat. No.	Wire Range	List Price ‡
1	15-20[1]	NB15-20	(1) #14-#2 Cu-Al		1	15-20	NBH15-20	(1) #14-#2 Cu-Al	
	25-50	NB25-50				30-50	NBH30-50		
2	15-20	NB215-20	(1) #14-#2 Cu-Al		2	15-20	NBH215-20	(1) #14-#2 Cu-Al	
	30-60	NB230-60				30-60	NBH230-60		
	70	NB270				70	NBH270		
	90-100	NB2P90-100	(1) #4-2/0 Cu/Al			90-100	NBH2P90-100	(1) #4-2/0 Cu/Al	
	125-150	NB2P125-150				125	NBH2P125		
3	15-20	NB3P15-20	(1) #14-1/0 Cu/Al		3	15-20	NBH3P15-20	(1) #14-1/0 Cu?Al	
	30-60	NB3P30-60				30-60	NBH3P30-60		
	70	NB3P70				70	NBH3P70		
	90-100	NB3P90-100				90-100	NBH3P90-100		

Note: 1.15A and 20A 1 pole NB Breakers are switching duty rated.

NB Ground Fault Breakers with 5 mA Sensitivity

Amps	Wire Range	1 Pole Cat. No.	List Price ‡	2 Pole Cat. No.	List Price ‡
15	(1) #14 -#8 Cu/Al	NBGF-15		NBGF-215	
20		NBGF-20		NBGF-220	
30		NBGF-30		NBGF-230	
40	(1) #14-#6 Cu/Al	NBGF-40		NBGF-240	

NB Ground Fault Breakers with 10 mA Sensitivity

Amps	Wire Range	2 Pole Cat. No.[2]	List ‡
15	(1) #14 -#8 Cu/Al	NBGF-215R10	
20		NBGF-220R10	
30		NBGF-230R10	
40	(1) #14-#6 Cu/Al	NBGF-240R10	

NB Ground Fault Breakers with 33mA Sensitivity

Amps	Wire Range	1 Pole Cat. No.	List Price‡	2 Pole Cat. No.	List Price‡
15	(1) #14 -#8 Cu/Al	NBGF-15-33		NBGF-215R33	
20		NBGF-20-33		NBGF-220R33	
30		NBGF-30-33		NBGF-230R33	
40	(1) #14-#6 Cu/Al	NBGF-40-33		NBGF-240R33	

Notes:

1. 10 kA IC at 120/240V. Overcurrent protection as well as ground fault protection.
2. Comes with remote indication and a 10 mA sensitivity. For the protection of submersible pumps which require 10 mA sensitivity under the Canadian Electrical Code 26-956.
3. Maximum distance to load is 250 feet.

Non-Automatic NB Switches

Poles	Amps	Cat. No.	List Price ‡
2	60	NB260NA	
	70	NB270NA	
	100	NB2P100NA	
3	60	NB3P60NA	
	70	NB3P70NA	
	100	NB3P100NA	

NB Breaker Accessories

Cat. No.	Description	Qty.	List Price
PF-1	Plastic Filler	25	
BFAB	Aluminum Filler	1	
HTNA	Handle Tie	1	
1LOB	1P Lockoff-Padlocking	10	
2LOK	2P Lockoff-Padlocking	10	
3-100LOK	3P Lockoff-Padlocking	10	
1LOK	1P Lockoff-Non-Padlocking	10	

Metering Devices

Meter	Switchboard	List Price ‡
Power Meter[1] PM 600	60-800/60100/60-400	
PM 620		
PM650		
CM-2150	60-100/60-400	
CM-2250		
CM-2350		
CM-2450		

Note:

1. Includes PMD-32 display monitor

PowerLogic

- Disturbance Monitoring
- True RMS Metering
- Over 50 displayed meter values, plus Min/Max displays for those values
- Power Quality Readings including: THD and K-Factor, Crest Factor
- RS-485 Communications standard (rear connected)
- Front panel optical communications port
- Modular, installable, digital and analog I/O
- CM-2150 includes instrumentation, 0.2% accuracy, and data loging
- CM-2250 includes waveform capture, plus CM-2150 features
- CM-2350 includes disturbance monitoring, extended memory, plus CM-2250 features
- CM-2450 includes programme logic, plus CM-2350 features

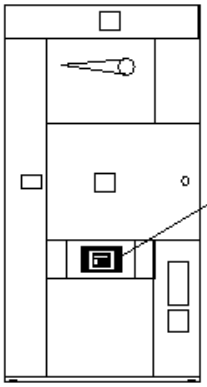
Power Meter

- Compact Design
- Multi-function metering
- Seperate Metering compartment not required
- PM 600 includes 0.25% meter accuracy, voltmeter, ammeter, watt-hour meter, frequency, power factor, meter pulse and remote communications
- PM 620 includes peak demand with date/time stamp, demand amps, THD, and neutral current, plus PM 600 features
- PM 650 extends the PM family by adding min/max readings, alarm/relay functions, advanced demand capabilities and logging memory for up to 100 meter readings and 10 event log entries. The PM 650 uses the same housing and display as existing Power Meters.

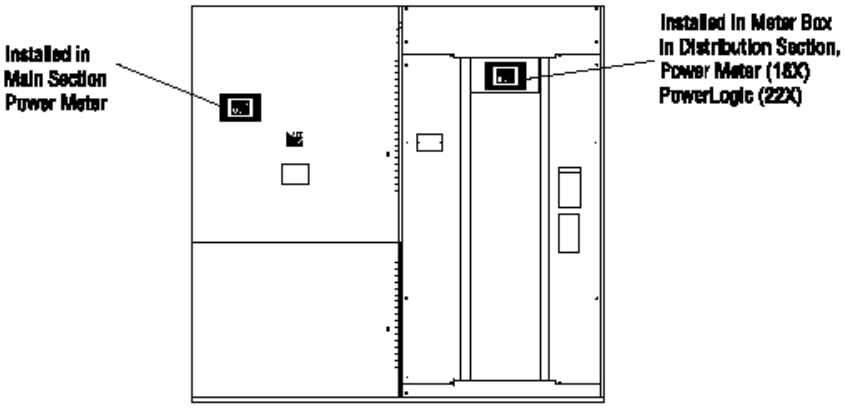
PowerLogic

Power Meter

Metering Locations



60-800



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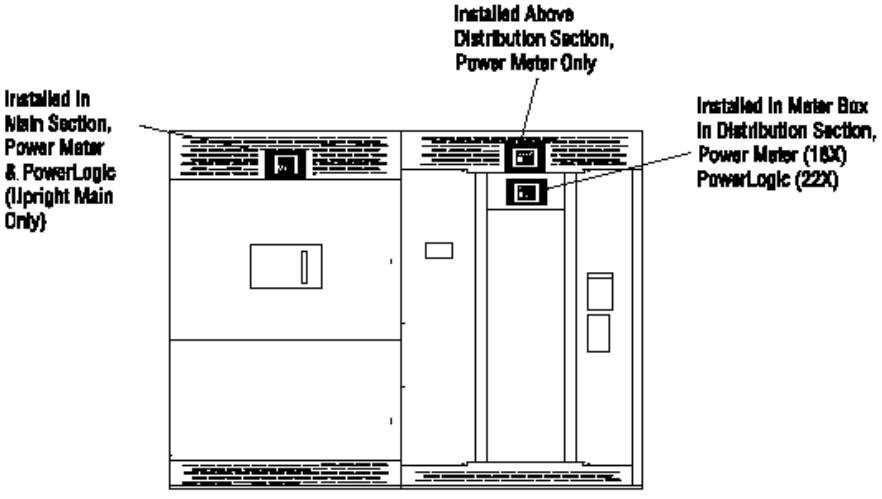

60-400

Switchboard Options

Description	Switchboard	List Price ‡
Driphood (per cell)	60-800 60-100 60-400	
Door Over Distribution (per cell)	60-800 60-100 60-400	
Channel Base	60-800 60-100 60-400	
Copper Bus (per cell)	60-800 60-100 60-400[1]	
Single Phase Protection	60-100 60-400	
Special Paint (per cell)	60-800 60-100 60-400	

Note: 1. Cu Bus standard on 4000/5000A 60-400

Description	Switchoard	List Price ‡
Fibre Entry/Exit Plate	60-800 60-100 60-400	
Aluminum Entry/Exit Plate	60-800 60-100 60-400	
Mimic Bus	60-800 60-100 60-400	
Quebec Hydro Ground Stud	60-800 60-100 60-400	
Surge Arrester	60-800 60-100 60-400	
Vermin Screen	60-100 60-400	

Corner Sections

Switchboard	Main Amps	List Price ‡	
		Al	Cu
60-100	400		
	600		
	800		
	1200		
60-400	1600		
	2000		
	2500		
	3000		
	4000		

Transition Sections

Switchboard	Main Amps	List ‡	
		Al	Cu
60-400	1600		
	2000		
	2500		
	3000		
	4000		

Bus Duct Entry/Exit Top Only (I-Line)

Switchboard	Main Amps	List Price ‡	
		Al	Cu
60-100	400		
	600		
	800		
	1200		
60-400	1600		
	2000		
	2500		
	3000		
	4000		

Catalog

05

Power-Zone® 4

Low Voltage, Metal-Enclosed, Drawout Switchgear with Masterpact® NW and NT Low Voltage Power Circuit Breakers

Class 6037

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Power-Zone® 4
Product Description

INTRODUCTION

Power-Zone® 4 low voltage, metal-enclosed, drawout switchgear is designed to provide superior electrical distribution, protection, and power quality management for the entire facility. The prime components of the switchgear are the Masterpact® NW and Masterpact NT ANSI-rated circuit breakers. Power-Zone 4 switchgear is designed to maximize the functionality of the Masterpact NW and NT circuit breakers, which, in turn, deliver maximum uptime, system selectivity, ease of maintenance and circuit protection. All of this in the smallest footprint available for low voltage drawout switchgear.

Features and Benefits

Figure 1: Power-Zone 4 Switchgear

- Power-Zone 4 is designed and built to ANSI® C37.20.1 and is listed to UL® 1558.
- Masterpact NW and NT drawout low voltage power circuit breakers are designed and built to ANSI C37.13 and C37.16., and are listed to UL1066.
- Short-circuit current rating up to 200 kA without fuses.
- High short-time withstand ratings up to 100 kA for 30 cycles.
- Family of field installable and upgradeable Micrologic® trip units with optional Powerlogic® data communications features.
- Smallest equipment footprint available in this product class.
- Front access to control and communications wire connections.
- Bolted copper bus provided as standard (up to 5000 A maximum).
- Large rear cable compartment pull area allows maximum room for power cables.
- Bus provision for future equipment expansion.
- System designed for maximum uptime with low maintenance.
- Modular circuit breaker design for easy addition of control accessories.

Figure 2: Through-the-Door Access

Figure 3: Circuit Breaker Compartment with Secondary Horizontal and Vertical Wireways

Figure 4: Powerlogic System Manager Software

Figure 5: Family of Micrologic Trip Units

Figure 6: Masterpact NT Circuit Breaker

Figure 7: Family of Masterpact NW Circuit Breakers

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Compartmentalization

Structures are compartmentalized and are built with barriers as required by ANSI C37.20.1. The structure has large conduit space within the main and feeder sections.

UL Listing

Power-Zone 4 switchgear is designed and engineered to comply with UL1558 requirements. Masterpact NW and NT circuit breakers are UL1066 listed. A UL label can be affixed where UL coverage exists for all component material, parts, and devices in a switchgear section.

Functional Capacity

High current carrying capacity frame sizes and high withstand rating make the Masterpact NW and NT circuit breakers ideal for application on today's high capacity distribution systems.

Maximum Uptime

Drawout construction allows quick and simple replacement of circuit breaker elements. If an emergency occurs, circuit breakers may be removed from low-priority circuits and re-installed to serve high-priority circuits.

Ease of Maintenance

Masterpact NW and NT circuit breakers provide disconnecting and overload protection for the circuit they control. Each is contained in an individual compartment and can be easily isolated from the energized circuit and withdrawn from the compartment for quick inspection, maintenance, or replacement. The entire switchgear or any other feeder circuits need not be shut down during this operation, thus minimizing production downtime.

Auxiliary Instrument Compartments

Optional control power transformers, meters, and other control devices can be mounted in the auxiliary instrument compartments. These compartments are furnished with hinged doors for easy access.

Secondary Horizontal and Vertical Wireways

The secondary wiring design allows for front access to circuit breaker control and communications wiring without removing the circuit breaker from its compartment. The vertical wireway is located on the right side of the circuit breaker for easy access and wiring installation. The horizontal wireway is located directly above the circuit breaker, providing direct access to control and communication terminations.

ANSI Interrupting and Short-Time (Withstand)

Power-Zone 4 switchgear with Masterpact NW and NT circuit breakers has the highest interrupting and short-time (withstand) ratings for low voltage switchgear in the smallest physical size. The elimination of limiter fuses for high interrupting Masterpact NW circuit breakers reduces space and cost. The ANSI rated circuit breaker's improved coordination with downstream devices increase system uptime.

Through-the-Door Construction

Masterpact NW and NT circuit breakers provide clear access to all circuit breaker controls, indicators, and trip unit functionality without opening the compartment door. Circuit breaker racking is also achieved with the compartment door closed.

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Disconnecting Contacts

The main disconnecting contacts (power plug-on fingers) on the rear of the circuit breaker are spring loaded and self-aligning to ensure positive electrical contact when the circuit breaker is in the connected position. The secondary disconnecting contacts are located on the top front of the circuit breaker element and are used for connecting the accessories to the control power source, other control circuits, or communication circuits.

Micrologic® Enhanced Functionality

A new family of Micrologic electronic and programmable trip units provide a choice of expanded information, power quality readings, and communication capabilities. Micrologic trip units can be integrated into the optional Powerlogic system.

Powerlogic® Monitoring System

Power-Zone 4 switchgear is available with the Powerlogic metering, data acquisition, and control system. The optional Powerlogic system is used in addition to, or in lieu of, the Type A, Type P, and Type H Micrologic® trip units for the Masterpact NW and NT circuit breakers. Powerlogic functions are included in Micrologic high-end trip units. Several highly accurate circuit monitors are available to work in conjunction with the Powerlogic System Manager Software to manage and control the electrical distribution system.

Equipment Standards

All Power-Zone® 4 switchgear are 100% rated and are assembled and tested in an ISO 9001 facility to applicable standards including:

Standard	Description
ANSI C37.20.1	Metal-enclosed low voltage circuit breaker switchgear
ANSI C.37.51	Testing of metal-enclosed low voltage ac circuit breaker switchgear
NEMA SG-5	Power switchgear assemblies
CAN/CSA C22.2 No. 31-M89	Switchgear assemblies
UBC and CBC	Zone 4 seismic applications
UL 1558	Switchgear assemblies

All Masterpact NW and NT circuit breakers are 100% rated and are assembled and tested in an ISO 9001 facility to applicable standards including:

Standard	Description
ANSI C37.13	Low voltage ac power circuit breakers used in equipment
ANSI C37.16	Preferred rating, related requirement and application recommendations for low voltage power circuit breakers and ac power circuit breakers
ANSI C37.17	Trip devices for ac and general-purpose dc low voltage power circuit breakers
ANSI C37.50	Testing of low voltage ac circuit breakers
NEMA SG-3	Low voltage circuit breakers
UL 1066	Low voltage circuit breakers

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Equipment Ratings

Application Voltage Systems	Ampacities
600 Vac Maximum	1600 A–5000 A (main circuit breaker or main lugs only)
1Ø3W, 3Ø3W, 3Ø4W	
50/60 Hz	

Short-Circuit Current Ratings			Short-Time Withstand Ratings
240 V	480 V	600 V	
42 kA	42 kA	42 kA	42 kA
65 kA	65 kA	65 kA	65 kA
85 kA	85 kA	85 kA	85 kA
200 kA	200 kA	130 kA	100 kA (maximum)

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SECTION 2 : GENERAL AND APPLICATION INFORMATION

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INTRODUCTION

Power-Zone® 4 switchgear with Masterpact® NW and NT circuit breakers provides the optimal switchgear solution in an industrial environment. The switchgear is designed for ease of use, system selectivity, system uptime, and low maintenance. The switchgear is easy to operate and maintain because of the technological advances in communications, power quality monitoring, and measuring capabilities.

The switchgear with drawout Masterpact NW and NT circuit breakers provides overload, short-circuit, and ground fault protection for circuits up to 600 volts. All trip unit and circuit breaker functions are operational from the front without opening the circuit breaker compartment door. Masterpact NW circuit breakers carry the highest interruption ratings without fuses, and require minimal space.

All Masterpact NW and NT circuit breakers can be equipped with Micrologic® electronic and programmable trip units to provide a choice of expanded information, power quality measurement, protection, and communication capabilities. Additionally, the optional high-end Micrologic trip units are compatible with the optional Powerlogic system.

The optional Powerlogic® data communications system can be used in lieu of or in addition to Micrologic trip units. The Powerlogic system uses highly accurate circuit monitors that work in conjunction with its System Manager Software to manage and control the electrical distribution system.

Power-Zone 4 switchgear is commonly found as the electrical service in the following applications:

- Chemical refinery
- Manufacturing
- Heavy assembly plants
- Large warehouses
- Semi-conductor manufacturing
- Textile mills
- Large office buildings
- University facilities
- Airports
- Data centers
- Hospitals
- Food and beverage facilities
- Wastewater and water treatment facilities

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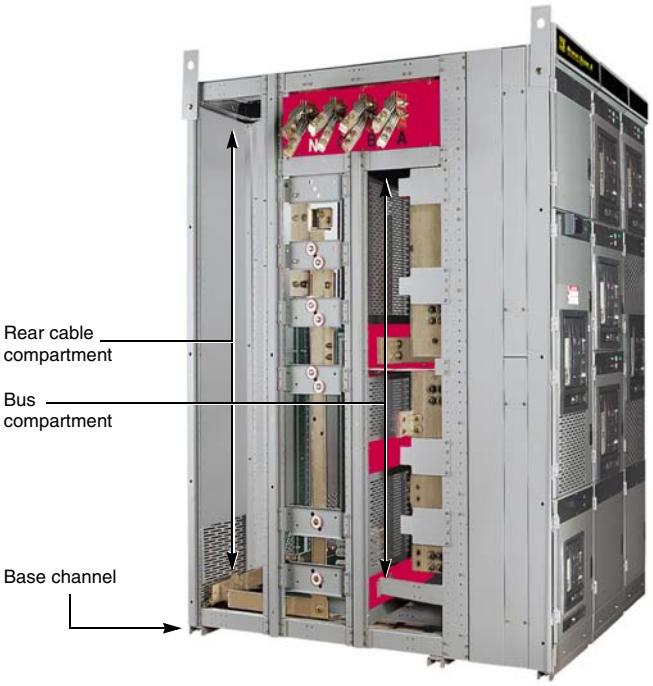
STRUCTURE

The switchgear assembly is composed of vertical sections arranged according to customer requirements. Each section is divided into a maximum of four compartments when using Masterpact NW circuit breakers, or a maximum of eight compartments when using Masterpact NT circuit breakers. One or more of these compartments can be used as an auxiliary instrument compartment containing potential transformers, meters, relays, and control devices.

A horizontal secondary wireway, containing the accessory terminal blocks, is directly above each circuit breaker. A spacious vertical wireway is on the right side of each circuit breaker compartment to allow wire routing through the switchgear.

Figure 3: Switchgear (Side View)



Power-Zone 4 switchgear offers compartmentalized construction. Each vertical section consists of three compartments: a front compartment (including secondary wireway), a bus compartment, and a rear cable compartment. The front compartment is divided into a maximum of four or eight compartments that can contain Masterpact NW or NT circuit breakers or auxiliary equipment. If desired, all compartments may be used for auxiliary equipment, circuit breakers, or a combination. The circuit breaker is positioned to allow ample room for control and communications wiring. Hinged doors on the auxiliary instrument compartment are available for mounting meters, relays, or other control equipment when it does not contain a circuit breaker. A circuit monitor display may be mounted on the hinged door of a compartment containing a main circuit breaker.

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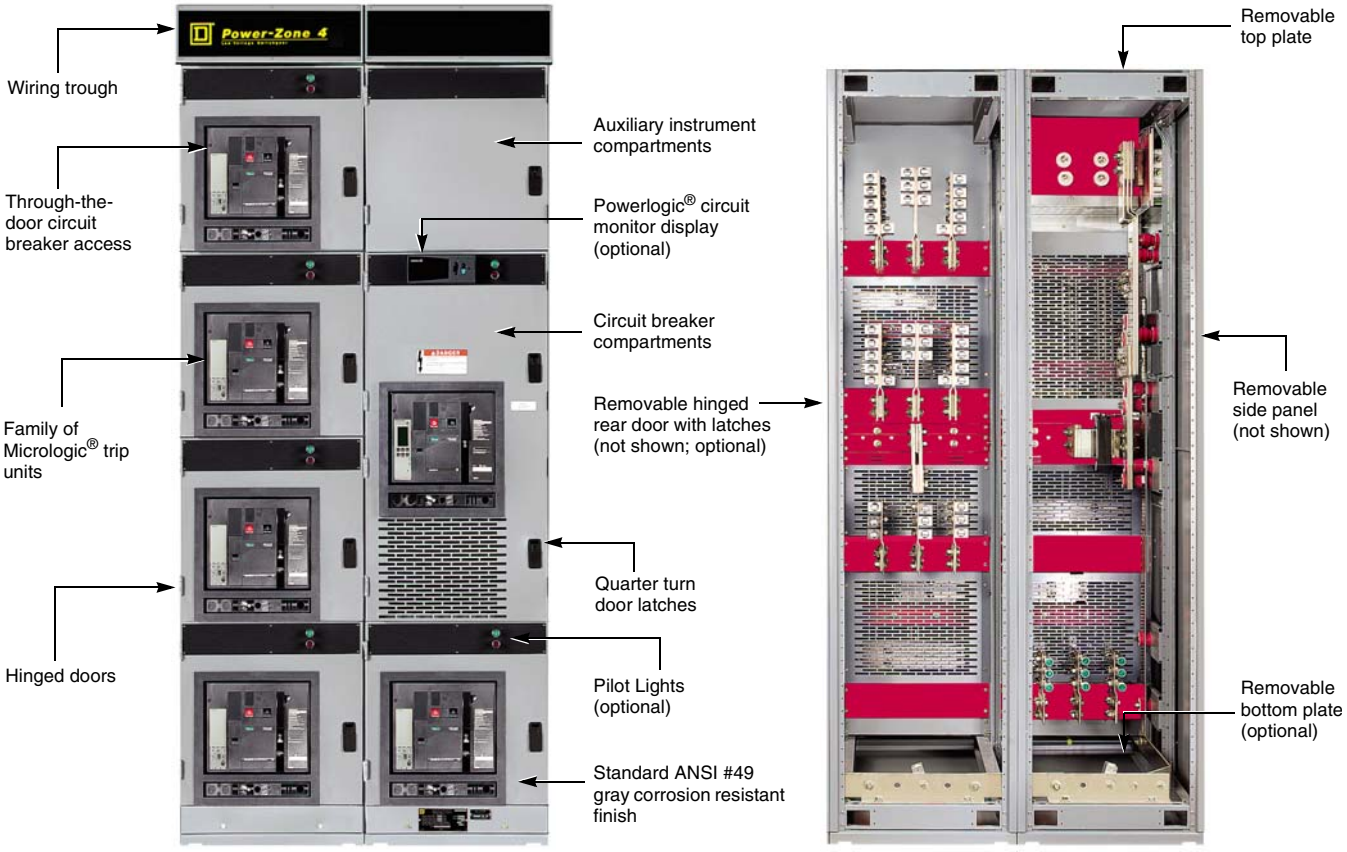
The examples below depict a typical Power-Zone 4 switchgear assembly.



Switchgear (Front View)

Switchgear (Rear View)

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ENCLOSURES

NEMA Type 1 Indoor Enclosures

The standard Power-Zone 4 switchgear enclosure is NEMA Type 1, general purpose. NEMA Type 1 enclosures are dead front, metal-enclosed structures. All sheet steel parts of the enclosure, inside and out, are painted using an electro-deposition process.

Figure 4: POWER ZONE 4 Switchgear, NEMA Type 1, Indoor Enclosure

Standard Features:

- Secondary wiring areas
- Removable, steel top plates over conduit entrance
- Hinged front doors with latches
- Circuit breaker or instrument compartment
- Bus compartment
- Cable compartment
- Capability for future expansion
- Two-piece removable side and back plates
- 1 1/2-inch-high base channels
- Electro-deposition paint process on structural parts
- ANSI #49 paint color
- Customer nameplates for each compartment
- White instrument mounting pans

Available Options:

- Vertical bus barriers
- Strip heaters in circuit breaker, bus, and cable compartments
- Overhead circuit breaker lifting device or floor crane
- Gasketing around doors and between sections
- Filtering of doors and vents
- Lockable, hinged rear doors
- Lockable, hinged front doors
- 18-inch-high pull box
- Bottom plates
- Rodent barriers

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NEMA Type 3R Walk-In Enclosures

Power-Zone 4 switchgear is also available in a NEMA Type 3R walk-in enclosure for outdoor installation.

Figure 5: NEMA Type 3R, Walk-In Outdoor Enclosure

NEMA Type 3R, Walk-In Outdoor Enclosure

Available Options:

- Exhaust fan ventilation/inside temperature control
- Exterior lighting
- Undercoating
- Inside emergency lighting
- Top entry/exit for incoming and outgoing cables

Standard Features:

- Front aisle with steel entrance door equipped with panic hardware
- Lockable, hinged rear doors
- Interior fluorescent lighting
- Three-way light switch and convenience outlets near the entrance door
- Strip heaters in circuit breaker and bus compartments
- Overhead circuit breaker lifting device (traveling lifter assembly)
- Removable gasketed steel cover plates over conduit entrance
- One-piece construction for ease of installation

  NOTE: Assembly may be required if shipped split.

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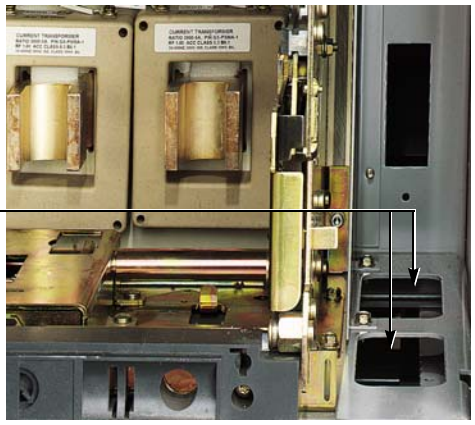
Control and Communications Wiring

Figure 6: Conduit Entrances

Top Control Conduit Entrance



Bottom Control Conduit Entrances

Control and communication wiring is installed and connected from the front of the switchgear. The secondary wiring design allows for circuit breaker compartment wiring without removing the circuit breaker from its compartment.

Control Conduit Entrances

The control wiring conduit entrance is in both the top and bottom of each section for maximum flexibility.

A removable top plate (4-inch by 5-inch) can be punched easily; up to four individual 3/4-inch control conduits per section.

Two bottom conduit entrances in each circuit breaker compartment permit cables to exit through the bottom of the compartment.

Horizontal Wireway

The secondary horizontal wireway (see Figure 7 on page 18) is directly above each circuit breaker compartment, allowing easy access to finger-safe secondary terminals. Each secondary terminal is dedicated to a specific function, allowing standardized wiring.

The secondary disconnecting contacts are on the top front of the circuit breaker element and connect the accessories to the control power source or other control circuits. These contacts are in the connected position when the circuit breaker is in the connect and test positions.

Vertical Wireway

The vertical wireway (see Figure 7 on page 18) is on the right side of the circuit breaker for quick and easy wiring installation.

Control and Communications Terminals

All accessory terminals are on a connecting block on the top front of the circuit breaker cradle and are accessible from the front, even with the circuit breaker in the test or disconnect position. This is particularly useful for field inspection and modification. The field-installable electrical accessories are UL Listed.

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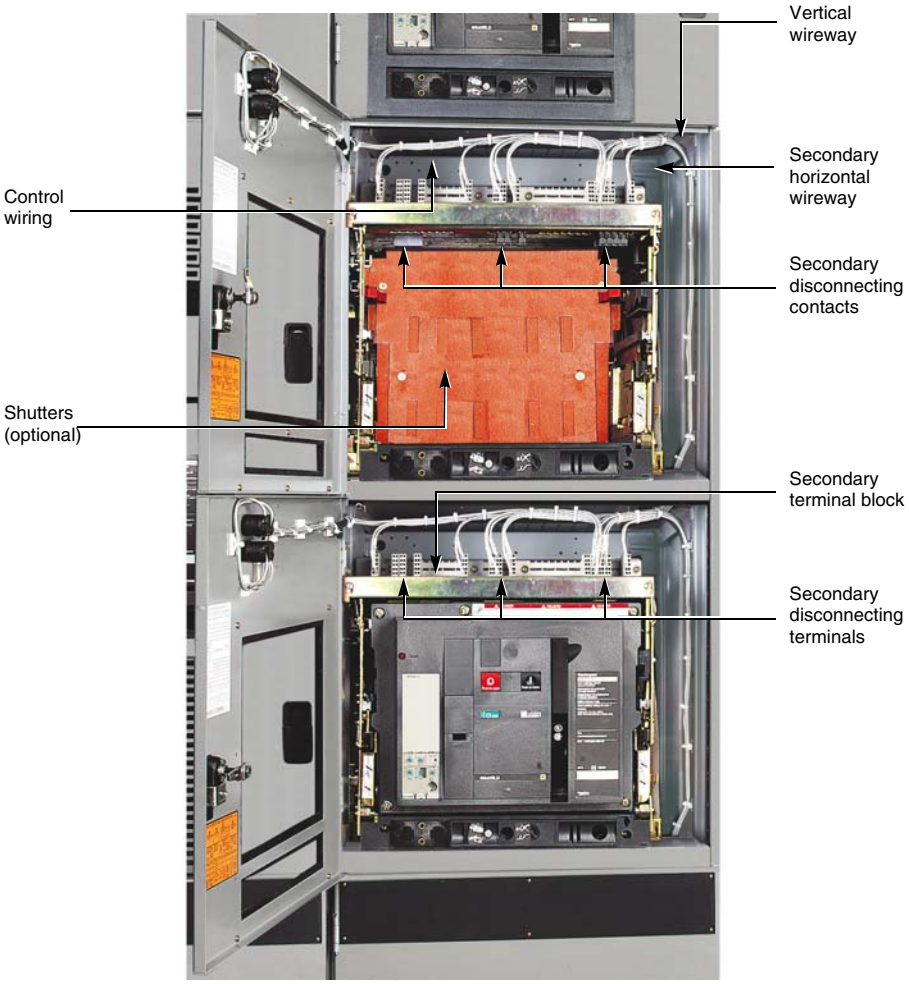
Figure 7: Secondary Wiring System



Standard Features:

- Control wires in wiring trough above the circuit breaker compartment
- Secondary terminal block originates directly from the circuit breaker without the use of an intermediate terminal block for factory and customer wiring
- Snap-in wire tie provisions
- Cage clamp terminal blocks locked directly on the circuit breaker cradle
- Control wiring AWG #14 SIS
- Metering CT wiring AWG #10 SIS
- Locking pull-apart terminal blocks at shipping splits
  - — Sleeve type “destination” wire markings
  - — Grommeted holes between circuit breaker compartments

Available Options:

- Ring tongue control wiring
- Communications wiring AWG #22 shielded

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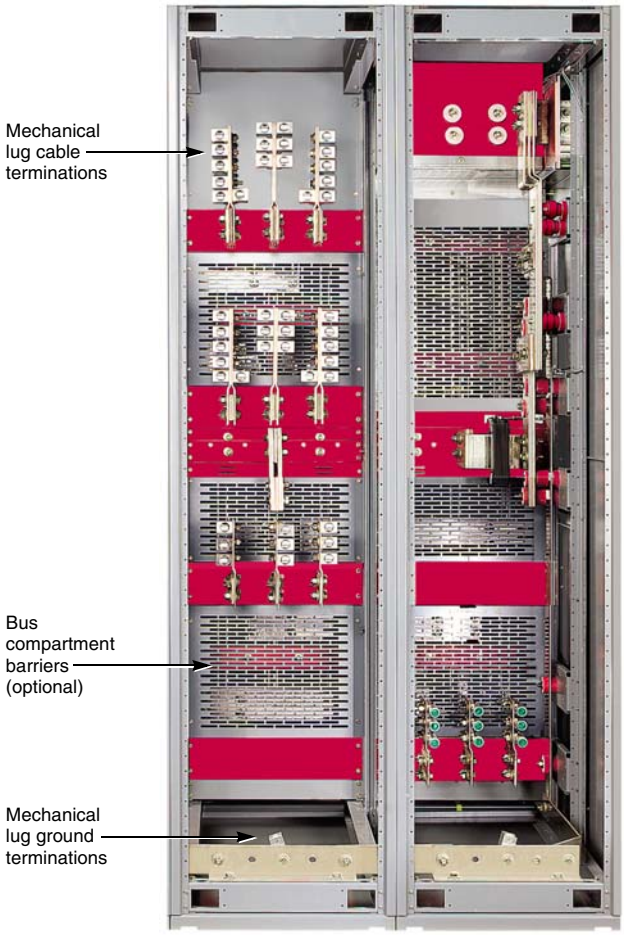
Rear Cable Compartment

The rear cable compartment is located behind the bus compartment. It provides room for rear access cable installation. Silver plated copper load bars extend from the load side of the circuit breaker's stationary connecting contacts into the cable compartment. Cable terminations on the load bars permit cables to exit through either the top or bottom of the vertical sections.

Figure 8: Rear Cable Compartment



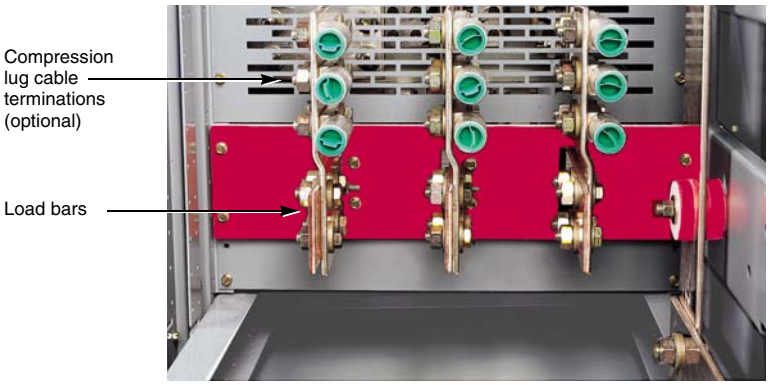
Standard Features:

- Mechanical lugs provided for customer connections
- Largest conduit area in this product class
- Two-piece removable rear covers (not shown)
- 3/0–750 kcmil lugs

Available Options:

- Compression lugs
- Cable supports
- Hinged full height rear door with padlock provisions
- Load connection to I-LINE® busway
- 18-inch pull box

Figure 9: Mechanical Lugs



Mechanical cable lugs are standard for customer cable connections. Optional compression lugs are available with Power-Zone 4 switchgear. Optional cable supports (not shown) provide additional assistance in customer wiring.

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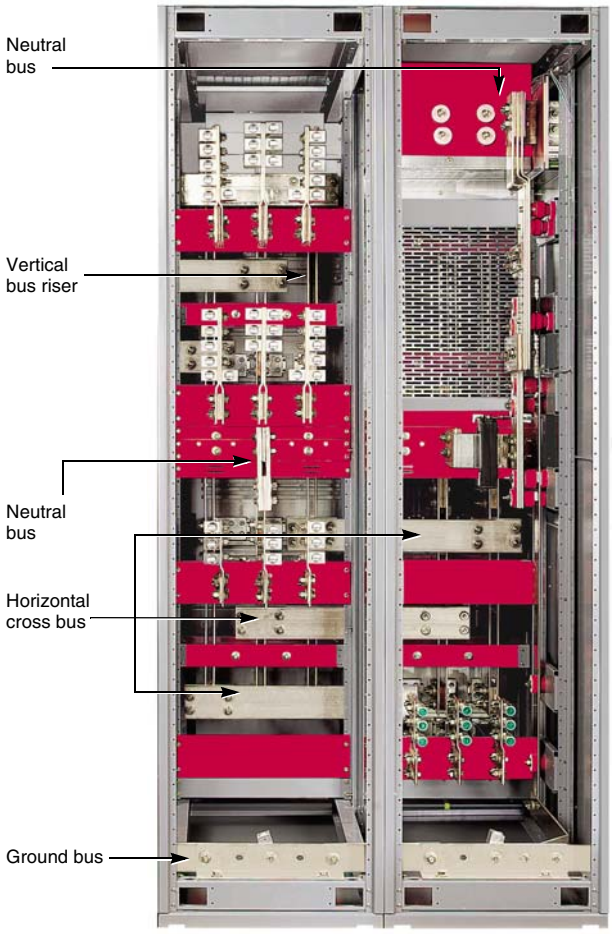
Bus Compartment

The bus compartment contains the horizontal and vertical bus, and is located between the circuit breaker compartment and the cable compartment. The bus compartment is separated from the circuit breaker compartment with grounded steel barriers. The optional side and rear barriers isolate the bus compartment from the rear cable compartment. In addition, service entrance barriers provide isolation around the incoming lines to meet UL and NEC requirements. Optional insulated bus helps protect the bus in harsh environments.

On four-wire systems, a neutral bus extends the length of the line-up and includes taps for the neutral cables in each vertical section. Feeder circuit breaker neutral sensors (current transformers) are provided on these taps when ground fault protection is supplied. A removable link to the ground bus is furnished, but not connected, in the main vertical section for grounded, four-wire systems. The ground bus is a plated copper bus bar that is bolted to the rear bottom of the cable compartment and extends the entire length of the switchgear.

All bus joints use a minimum of two grade-5 bolts and are secured with conical-type spring washers for maximum joint integrity. Bus sizing is based on ANSI/IEEE C37.20.1 continuous current test criteria. Standard bus is plated copper and is fully rated. All vertical and cross bus ratings in Power-Zone 4 switchgear are based on a standard temperature rise of 149 °F (65 °C) above a maximum ambient air temperature of 104 °F (40 °C).

Figure 10: Bus Compartment



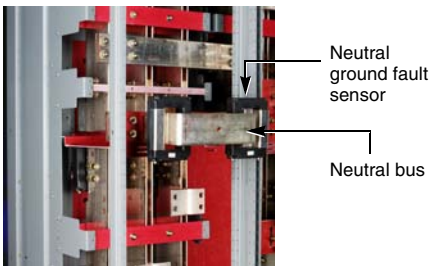
Bus Compartment (Rear View)

Standard Features:

- Silver plated copper bus bars
- Up to 5000 A continuous, 100% rated
- All bus bars are sized for full system capacity
- Minimum of two grade-5 bolt conical washer joints
- Sleeve type insulated runbacks

Available Options:

- Bus compartment barriers
- Side barriers in cable compartment
- Neutral bus center for easy terminations
- Tin plated copper bus
- Bus sized to 1,000 amps/in ^{2}
- Full insulated bus-sleeve type insulated with boots over joints



Bus Compartment (Side View)

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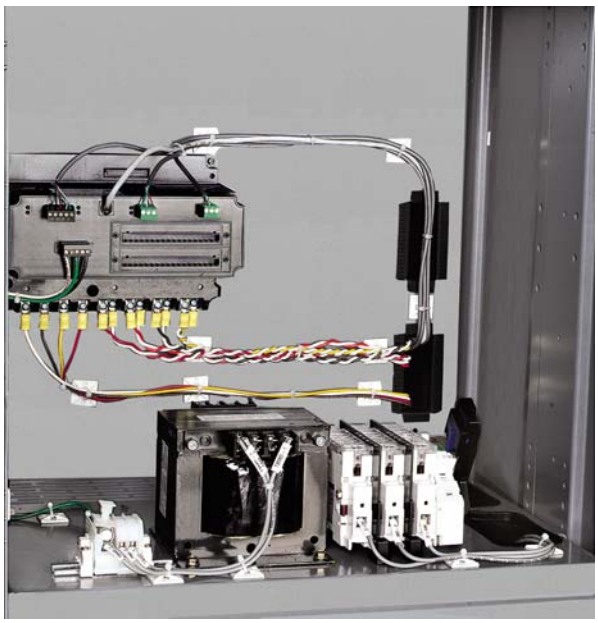
Auxiliary Instrument Compartments

Auxiliary instrument compartments are the same size as circuit breaker compartments. Typical auxiliary instrument compartments contain control power transformers, control components, meters, relays, and other optional devices. Circuit monitor displays and other metering devices can be mounted on the door.

Figure 11: Typical Auxiliary Instrument Compartment



Auxiliary Sections

Optional, full-height, auxiliary sections with hinged front doors are available that can be bolted to feeder and main switchgear sections. In addition, auxiliary sections can be provided with through bus as needed.

Key Locks and Padlocks

Optional key locks and padlocks can be provided for the door latches on circuit breaker compartments, auxiliary instrument compartments, auxiliary sections, and the rear doors on switchgear sections.

Moving and Handling Options

Whether configured as a single unit or as multiple units assembled together within a shipping group Power-Zone 4 switchgear enclosures are designed to withstand the rigors of lifting, handling, shipping, and setting into place. Maximum sizes are determined by shipping dimensions required for transportation on common carrier trucks and movement through standard equipment location openings (door and portals).

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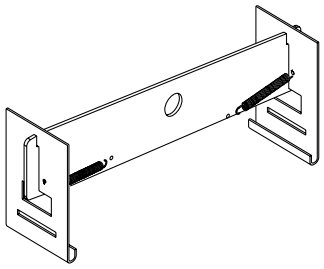
Figure 12: Circuit Breaker Lifter Bar



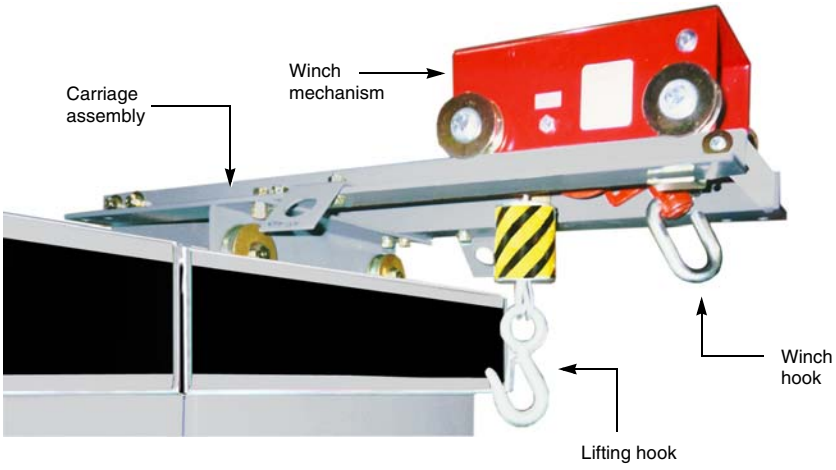
The circuit breaker lifter bar is used with both 3-pole and 6-pole Masterpact NW circuit breakers. The size of the circuit breaker determines whether the inside or outside notches on the lifter bar will be used.

Traveling Lifter Assembly

A rail-mounted, traveling type, circuit breaker lifting device is optionally available with indoor type switchgear. The lifting device is capable of lifting Masterpact NW or NT circuit breakers into and out of any compartment. The circuit breaker is raised or lowered by manually cranking the hoisting mechanism. The manually operated traveling lifter assembly is supplied with outdoor walk-in enclosures as standard.

NOTE: The lifting device is not available on enclosures with drip hoods.

Figure 13: Rail-mounted Circuit Breaker LIfting Device



Floor Crane (Not Pictured)

A floor crane can move into and out of any compartment, and can be used with the lifter bar to move a Masterpact circuit breaker into a dedicated work area.

NOTE: The floor crane can not be used in the outdoor walk-in enclosures.

Masterpact Circuit Breakers

The primary component of the Power-Zone 4 switchgear are the Masterpact NW and NT circuit breakers. The drawout circuit breaker design allows easy access to circuit breaker controls, indicators, and the trip unit without opening the circuit breaker compartment door.

Masterpact NT/NW circuit breaker features and benefits:

- Through-the-door construction with front-accessible key interlocks
- Buttons
- Indicators
- Individually-mounted
- ANSI rated,
- Four-position
- Low voltage power circuit breakers
- Up to 200 kA interrupting rating without fuses (NW)
- 42kA at 480 volts (NT)
- 100% rated, two-step stored energy mechanism
- 800 A–5000 A frame (NW)
- 800 A frame (NT)
- Field-installable, Micrologic trip units with optional Powerlogic, communications and monitoring features
- Enhanced functionality with low maintenance requirements

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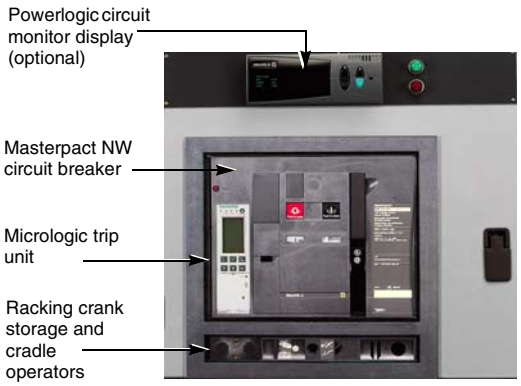
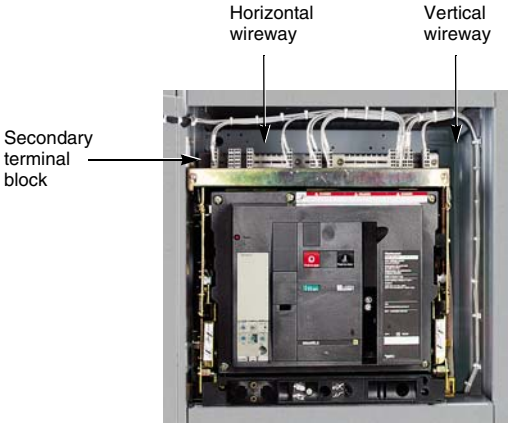
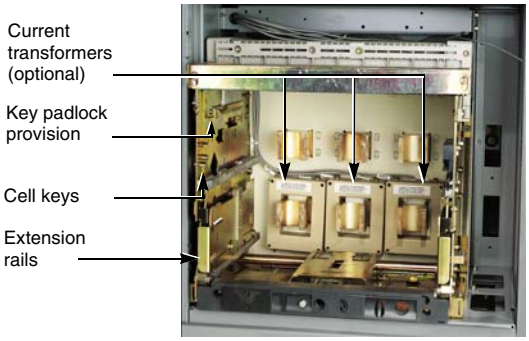
Figure 14: Through-the-Door Construction



Through-the-Door Access



Circuit Breaker Compartment



Circuit Breaker Compartment with Current Transformers

Through-the-Door Construction

The closing and opening push buttons, the racking handle, and racking mechanism are accessible through the front door cutout, allowing circuit breaker operation and disconnection without opening the door. Optional shutters (see "Secondary Wiring System" on page 18) can be provided, covering live parts when the circuit breaker is removed.

Masterpact NW and NT circuit breakers meet ANSI interlock requirements, including closing spring interlocking.

Circuit Breaker Compartment

The circuit breaker compartment consists of the circuit breaker cradle, a horizontal secondary terminal block on top of the cradle, and a vertical wireway on the right side of the compartment allowing for top and bottom customer wiring. The cradle structure is a bolted-in assembly that supports the circuit breaker. Integrated into the cradle are the circuit breaker interference interlocks or cell keys.

Cell keys are steel pins on the left side of the cradle. As the circuit breaker is pushed into the compartment, the bracket on the circuit breaker moves past a corresponding bracket on the cradle. If the circuit breaker is not matched correctly for the compartment, the brackets will interfere and the circuit breaker will not go into the compartment. Cell keying is a standard Power-Zone 4 switchgear feature.

The racking crank storage hole, racking crank hole, and “Push Stop Release” button are on the bottom of the cradle. Circuit breaker racking is achieved with the circuit breaker compartment door closed.

When required for metering, optional current transformers are positioned around the stationary main contacts.

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Interrupting and Short-Time (Withstand) Capability

Power-Zone 4 switchgear with Masterpact NW circuit breakers have the highest interrupting (200,000 A at 480 V without using fuses) and short-time (withstand) ratings for low voltage switchgear in the smallest physical size. The small switchgear footprint and the elimination of limiters reduces cost. The Masterpact NW and NT circuit breakers' wide range of coordination with downstream devices increases system uptime.

Masterpact NW circuit breakers are available in various levels of interrupting ratings (AIR). See "Masterpact NW and NT Circuit Breaker Interrupting Rating" on page 39.

NOTE: Circuit breakers of like frame sizes and interrupting ratings are interchangeable.

Circuit Breaker Types

Figure 15: Family of Masterpact Circuit Breakers (800 A–5000 A)

NW08, NW16, NW20, NW32 (800 A–3200 A) N1, H1, H2

NW08, NW16 (800 A–1600 A) L1, L1F

NW20 (2000 A) L1, L1F-Feeder

Number	Amperes
NW08N1 NW08H1 NW08H2 NW08L1 NW08L1F	800
NW16N1 NW16H1 NW16H2 NW16L1 NW08L1F	1600
NW20H1 NW20H2 NW20L1 NW08L1F	2000
NW32H1 NW32H2 NW32L1	3200
NW40H2 NW40L1	4000
NW50H2 NW50L1	5000
NT08N1	800

NW40, NW50 (4000 A–5000 A) H2, L1

NW20, NW32 (2000 A–3200 A) L1

NT08N1 (800 A)

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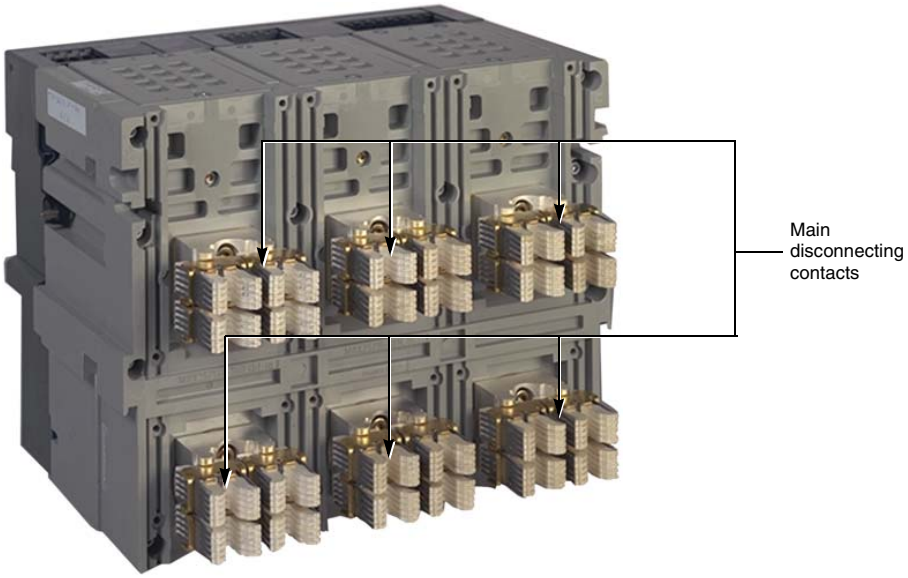
Circuit Breaker Parts

The Masterpact® NW circuit breaker has fewer parts than conventional circuit beakers while performing the same functions.

Figure 16: Masterpact NW Circuit Breaker (Front and Side View)

The main disconnecting contacts on the rear of the circuit breaker are spring loaded and self-aligning. These contacts are designed so the pressure at the point of contact on the stationary connectors becomes greater under short-circuit conditions.

Figure 17: Masterpact NW Circuit Breaker (Rear View)



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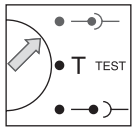
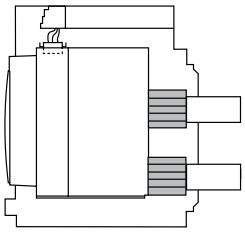
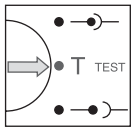
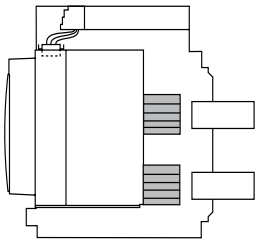
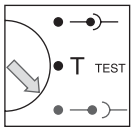
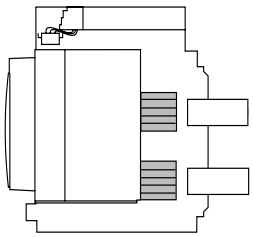
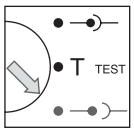
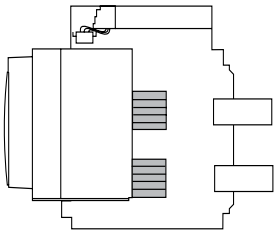
Circuit Breaker Operation

Power-Zone 4 switchgear with Masterpact NW and NT circuit breakers has through-the-door circuit breaker racking. The connect, test, and disconnect positions can be made with the circuit breaker compartment door closed.

Through-the-Door Circuit Breaker Position (side view)		Primary Connectors	Secondary (Control) Connectors	Circuit Breaker Functionality	Circuit Breaker Door Position
Connect 		Engaged	Engaged	a) Can be operated mechanically and electrically. b) Ready for service.	Closed
Test 		Disengaged	Engaged	a) Can be operated mechanically and electrically. b) Can have operation and control systems tested.	Closed
Disconnect 		Disengaged	Disengaged	a) Can not be operated remotely. b) Can not be removed from circuit breaker compartment.	Closed
Remove 		Disengaged	Disengaged	a) Can not be operated remotely. b) Can be removed from circuit breaker compartment.	Open Circuit breaker is fully extended on rails.

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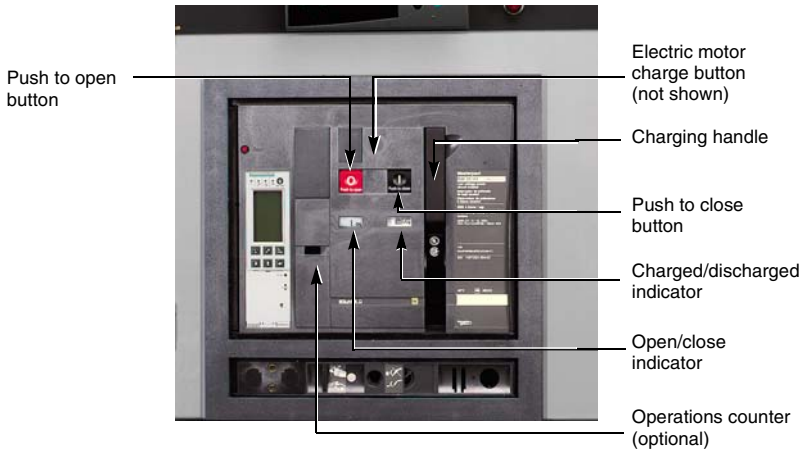
Two-Step Stored Energy Mechanism

Figure 18: Charging the Closing Springs



Masterpact NW and NT circuit breakers are stored energy devices with a two-step operating mechanism.

Electrically operated circuit breakers have a motor to charge the stored energy mechanism, electric close feature, and electric open feature.

On manually operated circuit breakers, the closing springs are charged by hand. For electrically operated circuit breakers, the springs are charged by an internal electric motor, but can also be manually charged if no control power is available.

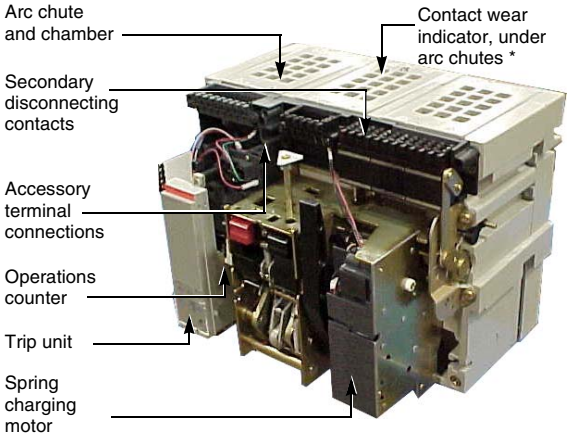
Status indicators on the front of the circuit breaker indicate when the closing springs are charged or discharged.

Circuit Breaker Inspection

When a Masterpact NW or NT circuit breaker is withdrawn on its rails, the circuit breaker is accessible for visual inspection. It is easy to remove the arc chutes and visually inspect the contacts and wear indicator. The operations counter can also indicate when inspections and possible maintenance should be done.

Figure 19: Masterpact NW Circuit Breaker

Masterpact NW Circuit Breaker on Its Rails



Masterpact NW Circuit Breaker Front Plate Removed

Removable, replaceable, and upgradeable circuit breaker parts include:

- Arc chutes
- Main disconnecting contacts or clusters
- Internal movable contacts
- Spring charging motor
- Trip unit

* The contact wear indication is available on Micrologic P and H trip units.

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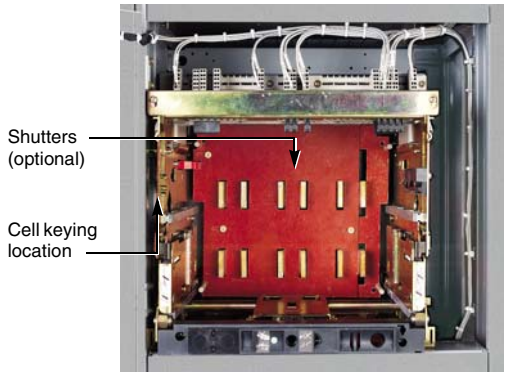
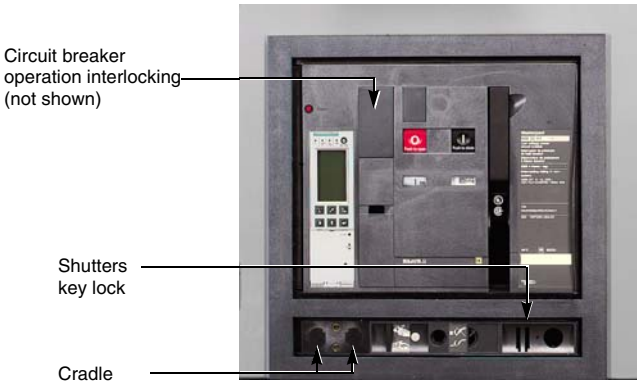
Circuit Breaker and Equipment Accessories

A number of Masterpact NW and NT circuit breaker accessories are available with Power-Zone 4 switchgear. A few of the most common accessories are listed below.



Circuit Breaker Compartment



Masterpact NW Circuit Breaker

NOTE: Refer to the Masterpact® NW and NT circuit breaker catalog for additional information.

Shutters:

Optional shutters in the cradle automatically block access to the main disconnects when the circuit breaker is in the disconnect, test, or remove position. An optional padlock attachment to lock shutters closed is also available.

Key Interlocks, Key Locks, and Padlocks:

Optional key interlocking can be provided with Masterpact NW and NT circuit breakers. Key interlocking capability is available for circuit breaker operation and the cradle.

Key interlock operation is outlined in the Power-Zone 4 switchgear order assembly drawings. To facilitate installation procedures, a key is supplied with each lock. After Installation, only the necessary keys called out on the key interlock diagrams should be present on the switchgear.

Cell Keying:

Cell keying, a standard feature on Power-Zone 4 switchgear, is provided to avoid insertion of circuit breakers with similar dimensions, but insufficient interrupting ratings, or incorrect frame sizes into an inappropriate circuit breaker compartment.

Auxiliary Switches:

A family of auxiliary switches that include:

- Open and close position switches (OF)
- Connected and closed position switches (EF); also known as cell switches
- Cradle position switch (CE, CD, CT)

Field-installable and Upgradeable Options:

A family of field-installable coils, buttons, motors, connectors, and trip units that include, but are not limited to:

- Trip units with or without Powerlogic® monitoring capabilities (see pages 29–30)
- Opening and closing coils (MX, XF)
- Additional shunt trip unit (MX)
- Undervoltage release (MN)
- Spring charging motor (MCH)
- Sensor plug

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Micrologic® Trip Units

A new family of field-installable trip units is available with Masterpact® NW and NT circuit breakers. The circuit breaker overcurrent protection consists of a solid-state, microprocessor-based tripping device that requires no external power source. The complete tripping system has three main components: the molded sensors, the trip device (with rating plug), and the trip actuator. The microprocessor-based trip unit uses true RMS current level sensing. For additional information, refer to the trip unit functionality matrix on page 41.

When a Masterpact NW or NT circuit breaker is closed, no external power is required for the protection system. The trip unit is powered by current signal levels and current sensors integrally mounted in the Masterpact NW or NT circuit breaker. All trip units are UL Listed for use in Masterpact NW or NT circuit breakers.

Basic Trip Unit

Micrologic Basic Trip Unit

Standard Trip Features:

- True RMS sensing
- LI trip configuration
- Field interchangeable long-time rating plugs
- LED long-time pickup indication
- Thermal imaging

Available Options:

- LSI trip configuration
- Test kits

Type A (Ammeter) Trip Unit

Micrologic Type A Trip Unit

Standard Trip Features:

- True RMS sensing
- LI trip configuration
- Field interchangeable long-time rating plugs
- LED long-time pickup indication LSIG trip configurations
- Digital ammeter–phase and neutral
- Phase loading bar graph
- LED trip indication
- Zone selective interlocking (ZSI) with short-time and ground fault
- Thermal imaging

Available Options:

- LSI trip configuration
- LSIG (ground fault trip)
- Test kits

Available Powerlogic® Features:

- Amps metering
- Circuit breaker open/close trip status
- Tripping curves

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Type P (Power Metering) Trip Unit

Micrologic Type P Trip Unit

Standard Trip Features:

- All standard features of Micrologic Type A trip unit
- LSI trip configuration
- Incremental “fine tuning” of L, S, I, and, when selected, G pickup and delay settings
- LCD dot matrix display and LED trip indication
- Advanced user interface
- Advanced user protection (includes, but not limited to):
  - over/under voltage
  - over/under frequency
- IDMTL: selectable long-time delay bands
- Thermal imaging
- Power measurement
- Contact wear indication
- Temperature indication
- Zone selective interlocking (ZSI) with short-time and ground fault

Available Options:

- LSIG (ground fault trip with programmable ground fault alarm)
- Test kits

Available Powerlogic Features:

- Amps metering
- Volts metering
- Energy accumulation
- Remote operation
- Circuit breaker open/close trip status
- Date/time stamping

Type H (Harmonics) Trip Unit

Micrologic Type H Trip Unit

Standard Trip Features:

- All standard features of Micrologic Type P trip unit
- Advanced power measurements functions
- Fault waveform capture

Available Options:

- LSIG (ground fault trip) with programmable ground fault alarm
- Zone selective interlocking (ZSI) with short-time and ground fault
- Test kits

Available Powerlogic Features:

- Amps metering
- Volts metering
- Energy accumulation
- Remote operation
- Waveform capture
- Data logging
- Circuit breaker open/close trip status
- Power quality measurements
- Harmonics measurements through 51st
- Date/time stamping

NOTE: Refer to the Masterpact® NW/NT circuit breaker catalog for detailed information about the family of Micrologic trip units.

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Powerlogic System

Power-Zone 4 switchgear is available with Powerlogic® metering, data acquisition, and control system features. The Powerlogic system is used in conjunction with Micrologic® Type A, Type P, and Type H trip units for the Masterpact NW and NT circuit breakers. The complete system is comprised of several devices including: circuit monitors, power meters, trip units, programmable logic controllers, digital relays, transformer temperature controllers, I/O, lighting control, and more. System Manager Software is available to work in conjunction with these devices to manage and control an electrical distribution system.

Modbus® industry standard data communications allow the Powerlogic system to replace discrete meters, multiple transducers, analog wires, and analog-to-digital conversion equipment. Extensive information can be transmitted over a single communications cable to a Powerlogic system display, a personal computer, programmable logic controller, or other host system.

The following Micrologic trip units are Powerlogic compatible:

- Type A
- Type P
- Type H

Basic circuit information, such as amperes, can be monitored using the Micrologic Type A trip unit. Circuit breaker remote operation is available using the Micrologic types P, and H trip units with Powerlogic functionality. For additional information, see the trip unit functionality matrix on page 41. For more sophisticated metering, power quality monitoring, data acquisition and control, Powerlogic circuit monitors may also be used.

Micrologic Trip Unit System Summary

In addition to its metering capabilities, the Micrologic trip unit system is available with optional status inputs and relay outputs for monitoring discrete contacts and remote control of devices by way of the data communications channel.

Micrologic trip unit metering functions include:

- Amperes and volts
- Frequency
- Power
- Power demand
- Energy
- Energy demand
- Power factor
- Power quality measurements
- Communications
- Fault waveform capture
- Waveform capture
- Data logging
- Programmable contacts

Micrologic trip unit relaying functions include:

- Current unbalance
- Over/under voltage
- Over/under frequency
- Voltage unbalance
- Phase loss
- Phase sequence
- Reverse power

Masterpact NW/NT circuit breaker maintenance information:

- Thermal imaging
- Contact wear indicator
- Temperature indication

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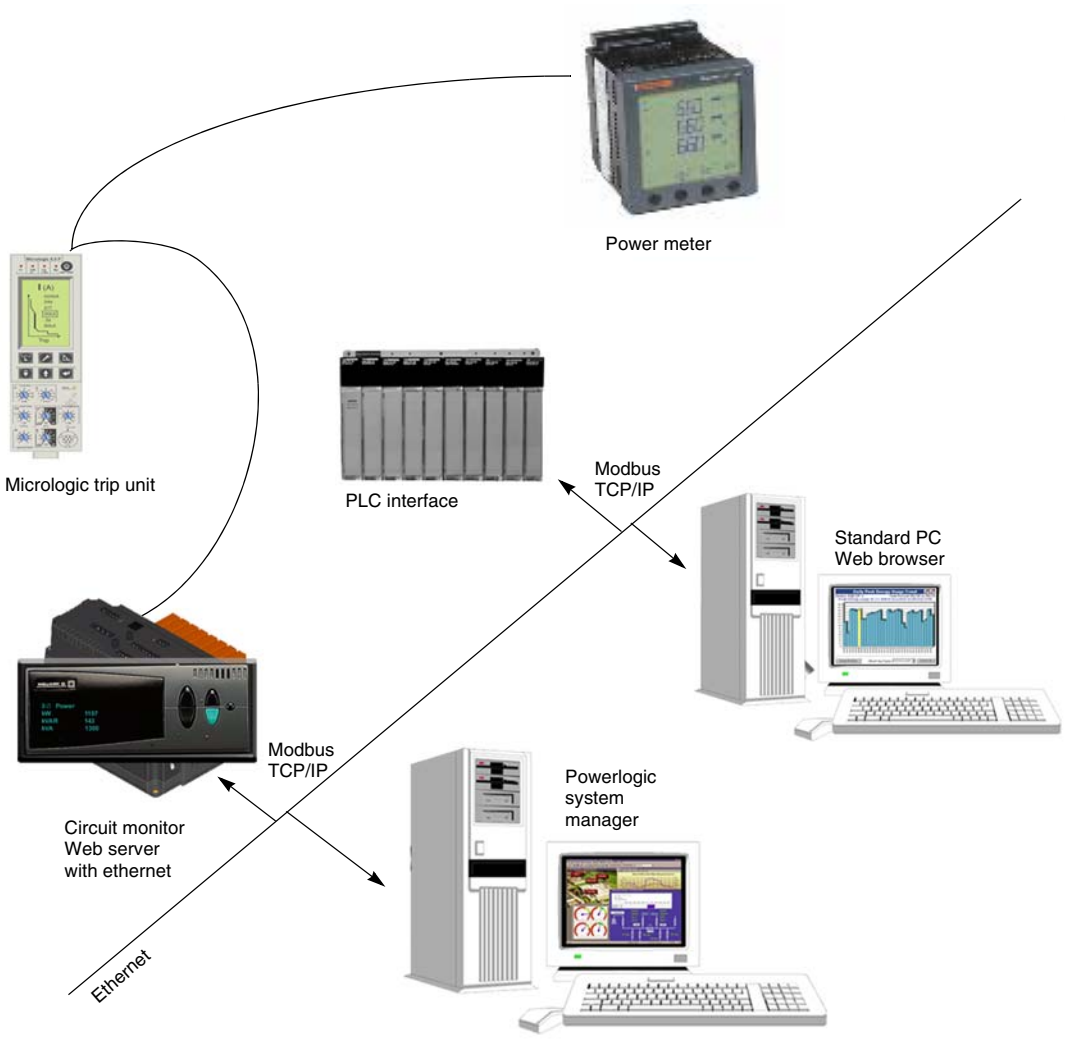
System Communications

The Powerlogic®, monitoring system, as well as Transparent Ready® Web Enabled (TRE) equipment, is available, as an option, with Power-Zone 4 switchgear.

The Powerlogic power monitoring and control systems, and (TRE) systems use a high-performance ethernet backbone with Modbus® communications. Information about the switchgear and its components is passed to and from a local or remote computer system using Powerlogic Modbus data communications.

Figure 20: Powerlogic Data Communications System / TRE



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System Components

Powerlogic® system components and additional features are listed below.

Powerlogic System Components:

- System Manager Software
- Powerlogic ethernet gateway
- NOE ethernet card
- TCP/IP Modbus®
- PLCs
- Circuit monitor
- Power meters
- Automatic control
- Digital relay
- Motor protection
- Transformer module
- Micrologic® trip units

Available Powerlogic Features:

- Custom software applications
- Communication interfaces

Circuit Monitors

Powerlogic circuit monitors provide highly accurate meter readings along with disturbance monitoring, analog and digital I/O, onboard logging, and more. Circuit monitors can be mounted on Power-Zone 4 switchgear, auxiliary instrument compartments, and auxiliary sections.

Figure 21: Powerlogic Circuit Monitor Display

Detailed information about the Powerlogic system and components can be found in the Powerlogic monitoring and control system catalogs.

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ARC FLASH PROTECTION WITH MASTERPACT NW CIRCUIT BREAKERS

What is an Arc Flash?

An arc flash occurs when insulation or isolation between electrified conductors is breached or can no longer withstand the applied voltage. As employees work on or near energized conductors or circuits, movement near or contact with the equipment (or a failure of the equipment) may cause a phase-to-ground and/or a phase-to-phase fault. Temperatures of more than 5,000 degrees Fahrenheit and a powerful explosion can be produced in an arc flash incident. The Occupational Safety and Hazard Administration (OSHA) has begun to enforce the NFPA 70E safety guidelines for arc flash safety. The guidelines:

- provide analysis detailing arc flash incident energy, boundary distances, and the Personal Protective Equipment (PPE);
- state that PPE must be provided;
- mandate proper worker training;
- provide procedures for safe work practices;
- state that tools for a safe work environment must be provided; and
- state that equipment be installed in accordance with the safety requirements of the *National Electrical Code*.

Masterpact NW Circuit Breaker Technology

Breakthrough technology was used to design the new Masterpact® NW circuit breakers to interrupt large amounts of fault current without being protected by fuses. The same technology and design that allows the Masterpact NW and NT circuit breakers to interrupt large fault currents without fuses also provides very good arc flash limitation. The decision to design the Masterpact NW to eliminate the need for fuse protection is based on the following:

- Requirements for smaller footprints and space-saving installations;
- Avoidance of fuse installation, maintaining supplies, and the need to enter the equipment in order to check and change fuses;
- The need to be adjustable to provide coordination with downstream products and better arc flash protection.

Advantages of using Masterpact breakers and Power-Zone 4 switchgear when there are Arc Flash concerns:

- Arc Flash limiting feeder breakers up to 2000A reduce arc incident energy on downstream equipment such as motor control centers (MCC's) and power distribution panels (PDP's).
- Through-the-door breaker operation allows unit to be operated/racked while door is closed, this reduces NFPA 70E PPE category by one level.
- Optional rear hinged doors allow easy access to cables, this reduces NFPA 70E 2004 PPE category by one level.
- Masterpact arc flash breaker equations are easily inserted into software packages such as SKM Analysis to get these testing results.

For further information on applying Masterpact breakers for arc flash protection, refer to data bulletins 0613DB0202 and 0100DB0402.

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Calculating Arc Flash Incident energy using Masterpact NW L1F circuit breakers

Example 1:

Bolted fault currents at MCC is I_b = 17kA, bolted fault current at PDP is I_b = 40kA. Using the following Masterpact NW-LF equations from actual testing, we calculate the incident energy to be 1.15 cal/cm^2 at the MCC and 3.31 cal/cm^2 at the PDP. This allows workers to wear Class 0 and 1 PPE per NFPA 70E when working on or around energized parts. In addition to incident energy, flash protection boundaries can be calculated as well.

To calculate incident energy, use the following equations:

800 A NW-L Masterpact Circuit Breaker

- $E = 0.067 + 0.064 \times I_b$ for $15 \leq I_b \leq 42$ kA
- $E = 2.16 + 0.017 \times I_b$ for $42 < I_b \leq 100$ kA

1600 / 2000 A NW-L Masterpact Circuit Breaker

- $E = 1.43 + 0.047 \times I_b$ for $20 \leq I_b \leq 50$ kA
- $E = 2.70 + 0.020 \times I_b$ for $50 < I_b \leq 65$ kA

800 A NT-L Masterpact Circuit Breaker

- $E = 0.47 + 0.0036 \times I_b$ 0for $10 \leq I_b \leq 100$ kA

Where:

- E is incident energy in calories/cm^2
- I_b is available bolted fault current in kilocamperes at the location of interest
- Working distance is 18 inches (457 mm) from the point of arcing
- Instantaneous trip setting is set at maximum (lower settings may result in lower incident energy values)

To calculate a flash protection boundary, use the following equations:

800 A NW-L Masterpact Circuit Breaker

- $D_b = 245 + 12.5 \times I_b$ for $15 \leq I_b \leq 42$ kA
- $D_b = 667 + 2.63 \times I_b$ for $42 < I_b \leq 100$ kA

1600 / 2000 A NW-L Masterpact Circuit Breaker

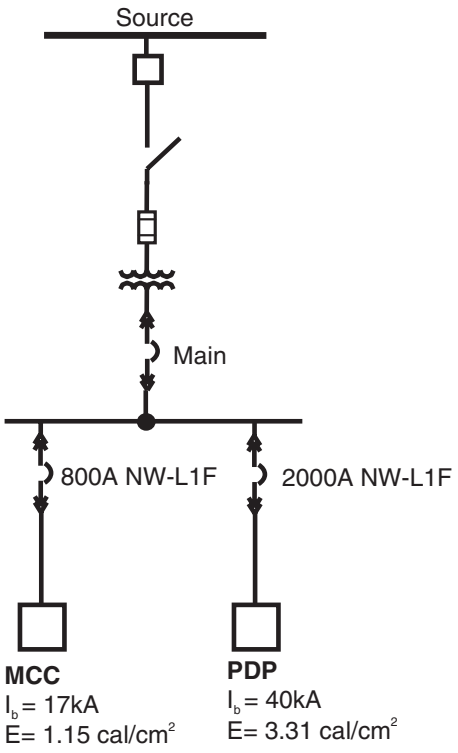
- $D_b = 541 + 7.6 \times I_b$ for $20 \leq I_b \leq 50$ kA
- $D_b = 775 + 2.92 \times I_b$ for $50 < I_b \leq 65$ kA

800 A NT Masterpact Circuit Breaker

- $D_b = 260 + 1.06 \times I_b$ for $10 \leq I_b \leq 100$ kA

Where:

- D_b is the flash protection boundary in millimeters
- I_b is available bolted fault current in kilocamperes at the location of interest
- Working distance is 18 inches (457 mm) from the point of arcing
- Instantaneous trip setting is set at maximum (lower settings may result in lower incident energy values)



Example 1

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SECTION 3 : TECHNICAL OVERVIEW

SECTION CONTENTS

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"Power-Zone 4 Switchgear Ratings" 38
"Masterpact NW and NT Circuit Breakers" 38
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INTRODUCTION

This section contains basic technical information pertaining to the Power-Zone 4 switchgear, Masterpact® NW and NT circuit breakers, and Micrologic® trip units.

Power-Zone 4 Switchgear Ratings

Power-Zone 4 switchgear is industrial-duty equipment built to ANSI standards and uses 100% rated Masterpact NW and NT circuit breakers. Switchgear ratings are listed below.

Switchgear
120/208 to 600 Vac, 1Ø3W, 3Ø3W, or 3Ø4W
1600 A – 5000 A
50/60 Hz
up to 200 kA symmetrical short-circuit current

Bus Type	Continuous Amperes	Short-circuit current	Short-time Withstand
Cross	1600, 2000, 3200, 4000, 5000	65 kA, 85 kA, 100 kA, 130 kA, 200 kA	50 kA, 65 kA, 85 kA, 100 kA
Vertical	1600, 2000, 3200, 4000, 5000	65 kA, 85 kA, 100 kA, 130 kA, 200 kA	50 kA, 65 kA, 85 kA, 100 kA
Neutral	1600, 2000, 3200, 4000, 5000 NOTE: 50% ratings available	65 kA, 85 kA, 100 kA, 130 kA, 200 kA	50 kA, 65 kA, 85 kA, 100 kA

Masterpact NW and NT Circuit Breakers

This section contains basic Masterpact NW and NT circuit breaker interrupting, sensor, operating time, control power requirements, and switch ampere ratings. In addition, an overview of key interlock operation is described on page 41.

Ratings

Power-Zone 4 switchgear with Masterpact NW circuit breakers has the highest interrupting and short-time (withstand) ratings for low voltage switchgear in the smallest physical size. The small switchgear footprint and the elimination of limiters reduces cost. The circuit breaker's improved coordination with downstream devices increases system uptime.

Power-Zone 4 switchgear using Masterpact NT circuit breakers allows the use of up to eight (8) 800 A frame breakers in a single, 30-inch wide section. This lets the user maintain a high concentration of power protection devices in a small physical size.

Masterpact NW circuit breakers are available in various levels of interrupting ratings (AIR) as listed in Table 1: on page 39.

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Table 1: Masterpact NW and NT Circuit Breaker Interrupting Rating

Trip Current Range	Circuit Breaker Model #	Instantaneous Trip Rating (A)			Short-time Trip Rating (A)		
		208 V–240 V (254 V Max.)	480 V (508 V Max.)	600 V (635 V Max.)	208 V–240 V (254 V Max.)	480 V (508 V Max.)	600 V (635 V Max.)
40–800	NW08N1	42,000	42,000	42,000	42,000	42,000	42,000
40–800	NW08H1	65,000	65,000	65,000	65,000	65,000	65,000
40–800	NW08H2	85,000	85,000	85,000	85,000	85,000	85,000
40-800	NW08H3	100,000	100,000	85,000	85,000	85,000	85,000
40–800	NW08L1[1]	200,000	200,000	130,000	30,000	30,000	30,000
40–800	NW08L1F	200,000	200,000	130,000	22,000	22,000	22,000
320–1600	NW16N1	42,000	42,000	42,000	42,000	42,000	42,000
320–1600	NW16H1	65,000	65,000	65,000	65,000	65,000	65,000
320–1600	NW16H2	85,000	85,000	85,000	85,000	85,000	85,000
320–1600	NW16H3	100,000	100,000	85,000	85,000	85,000	85,000
320–1600	NW16L1[1]	200,000	200,000	130,000	30,000	30,000	30,000
320–1600	NW16L1F	200,000	200,000	130,000	22,000	22,000	22,000
400–2000	NW20H1	65,000	65,000	65,000	65,000	65,000	65,000
400–2000	NW20H2	85,000	85,000	85,000	85,000	85,000	85,000
400–2000	NW20H3	100,000	100,000	85,000	85,000	85,000	85,000
400–2000	NW20L1[1]	200,000	200,000	130,000	30,000	30,000	30,000
400–2000	NW20L1F	200,000	200,000	130,000	22,000	22,000	22,000
640–3200	NW32H1	65,000	65,000	65,000	65,000	65,000	65,000
640–3200	NW32H2	85,000	85,000	85,000	85,000	85,000	85,000
640–3200	NW32H3	100,000	100,000	85,000	85,000	85,000	85,000
640–3200	NW32L1[1]	200,000	200,000	130,000	100,000	100,000	100,000
800–4000	NW40H2	85,000	85,000	85,000	85,000	85,000	85,000
800–4000	NW40H3	100,000	100,000	85,000	85,000	85,000	85,000
800–4000	NW40L1[1]	200,000	200,000	130,000	100,000	100,000	100,000
1000–5000	NW50H2	85,000	85,000	85,000	85,000	85,000	85,000
1000–5000	NW50H3	100,000	100,000	85,000	85,000	85,000	85,000
1000–5000	NW50L1[1]	200,000	200,000	130,000	100,000	100,000	100,000
40-800	NT08N1	42,000	42,000	N/A	42,000	42,000	N/A

[1] Note: L1 circuit breakers cannot be combined with N1, H1, or H2 circuit breakers within the same switchgear lineup.

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Table 2: Various Sensor Capacities of Masterpact NW and NT Circuit Breakers.

Circuit Breaker Type		Sensor Rating (Amperes)
NW08N1 NWO8H1 NW08H2	NW08H3 NW08L1 NW08L1F	100, 250, 400, 600, 800
NW16N1 NW16H1 NW16H2	NW16H3 NW16L1 NW16L1F	800, 1200, 1600
NW20H1 NW20H2 NW20H3	NW20L1 NW20L1F	1200, 1600, 2000
NW32H1 NW32H2	NW32H3	1600, 2000, 2500, 3000, 3200
NW32L1		1600, 2000, 2500, 3000, 3200,
NW40H2 NW40H3	NW40L1	2000, 2500, 3000, 3200, 4000
NW50H2 NW50H3	NW50L1	2500, 3000, 3200, 4000, 5000
NT08N1		100, 250, 400, 600, 800

NOTE: Minimum sensor rating is 50% of frame rating (except for 800 A frame).

Table 3: Masterpact NW/NT Circuit Breaker Approximate Operating Time Ratings

Action	Time
Spring charging motor (MCH)	
Response time	70–80 milliseconds
Charging time	3–4 seconds (max)
Shunt trip (MX)	50 milliseconds
Shunt close (XF)	70–80 milliseconds

Table 4: Control Power-NW/NT Circuit Breakers and PZ-4 Switchgear Equipment

Action	Power Consumption
Spring Charging Motor Current (electrically operated circuit breakers)	180 VA
Closing coil (XF)	4.5 VA
Shunt trip coil (MX)	4.5 VA
Time delay under/voltage trip (MN)	20 VA
Status indicating lights (each)	2 VA
Circuit monitor	22 VA
Strip heater (each)	125 VA

Table 5: Approximate Ampere Ratings for Masterpact NW/NT Circuit Breaker Switches

Action	Ampere (240 V)
Auxiliary switch (OF)	10 A
Overcurrent trip switch (SDE)	10 A
Combined (connect/close) switch (EF)	10 A
Cradle cell switch	10 A

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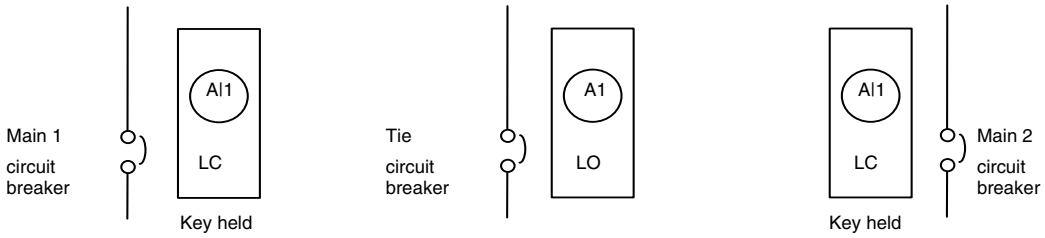
Key Interlock Operation

As shown in the example below, a main-tie-main manual key interlock scheme is designed to keep all three circuit breakers from being closed simultaneously. Only two of the three circuit breakers can be closed simultaneously.

NOTE: Spare keys should be removed and kept safely stored and under the control of responsible supervision.

Figure 22: Main-Tie-Main Key Interlocking



Main 1 and main 2 circuit breakers are closed with their keys placed in the lock cylinders. The tie circuit breaker is locked open; a key is required to unlock it and put the circuit breaker into service.

The main 1 circuit breaker is opened and taken out of service. It is locked open, permitting key A1 to be removed to operate the lock associated with the tie circuit breaker. Then the main 1 circuit breaker cannot be put into service and closed until either the tie circuit breaker, or the main 2 circuit breaker, is opened and locked out of service. This would free one key for use in unlocking the main 1 circuit breaker.

Micrologic Trip Units

Micrologic® trip unit ratings, functionality, and curves are listed below.

Ratings

Standard Micrologic adjustable trip settings, including time/current characteristics, pickup settings, pickup points, and time band in seconds are listed below.

Time/Current Characteristic	Pickup Setting	Pickup Point [a]	Time Band, Seconds
Long-time Delay	0.4, 0.45, 0.5, 0.625, 0.7, 0.8, 0.9, 1.0	I_n Times Long-time Delay Setting	0.5, 1, 2, 4, 8, 12, 16, 20, 24 (at 6 times pickup value)
Instantaneous	2, 3, 4, 6, 8, 12, 15, OFF	I_n Times Instantaneous Setting	
Short-time Delay	1.5, 2, 2.5, 3, 4, 5, 6, 8,10	I_r Times Short-time Delay Setting	0.0, 0.1, 0.2, 0.3 (Flat Response) 0.0, 0.1, 0.2, 0.3, 0.4 (I^2t Response)
Ground Fault	A (0.3), B (0.3), C (0.4), D (0.5), E (0.6),F (0.7), G (0.8), H (0.9), J(1.0) (1200 A Max.)	I_n Times Ground Fault Setting	0.0, 0.1, 0.2, 0.3, 0.4 (Flat Response) 0.0, 0.1, 0.2, 0.3, 0.4 (I^2t Response)

[a] I_n = Sensor Plug Value I_r = Long Delay Pickup Setting X I_n

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Functionality

The table below lists the standard and optional trip unit features for Micrologic Type A (Ammeter), Type P (Power Metering), and Type H (Harmonics) trip units for use in Power-Zone 4 switchgear.

Functions	Basic	Type A	Type P	Type H
True RMS sensing	X	X	X	X
LI trip configuration	X	X	X	X
LSI	O	O	X	X
LSIG/ground fault trip	–	O	X	X
Ground fault alarm (no trip)	–	–	X	X
Ground fault trip and programming alarm	–	–	O	O
Adjustable rating plugs	X	X	X	X
LED – long–time pickup	X	X	X	X
LED – trip indication	–	X	X	X
Digital ammeter	–	X	X	X
Phase loading bar graph	–	X	X	X
Zone selective interlocking	–	X	X	X
Communications	–	O	X	X
LCD dot matrix display	–	–	X	X
Advanced user interface	–	–	X	X
Protective relay functions	–	–	X	X
Thermal imaging	–	–	X	X
Contact wear indication	–	–	X	X
Temperature indication	–	–	X	X
Incremental fine tuning of settings	–	–	X	X
Selective long-time delay bands	–	–	X	X
Power measurement	–	–	X	X
Waveform capture	–	–	–	X
Data logging	–	–	–	X

Table Values:

–	Not Applicable
X	Standard Feature
O	Optional Feature

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Trip Curves

This section contains typical characteristic trip curves for Micrologic trip units in Power-Zone 4 switchgear. Detailed information about Micrologic trip units can be found in the Masterpact NW circuit breaker catalog.

- "Typical Micrologic 6.0 A/P/H Trip Units with Adjustable Ground-fault Pickup and Delay (Ground Fault I^2t OFF and ON / I_n < 400 A)" on page 44
- "Typical Micrologic 6.0 A/P/H Trip Units with Adjustable Ground-fault Pickup and Delay (Ground Fault I^2t OFF and ON / 400 A < I_n < 1200 A)" on page 45
- "Typical Micrologic 6.0 A/P/H Trip Units with Adjustable Ground-fault Pickup and Delay (Ground fault I^2t OFF and ON / I_n > 1200A)" on page 46
- "Typical Micrologic 5.0/6.0 A/P/H Trip Units (Long-time Pickup and Delay / Short-time Pickup and I^2t OFF Delay)" on page 47
- "Typical Micrologic 5.0/6.0 A/P/H Trip Units (Short-time Pickup and I^2t ON Delay)" on page 48
- "Typical Micrologic 3.0 A Trip Unit (Long-time Pickup and Delay)" on page 49
- "Typical Micrologic 5.0/6.0 Trip Units (instantaneous Pickup, 2X to 15X and OFF)" on page 50
- "Typical Micrologic 3.0 A Trip Unit (Instantaneous Pickup, 1.5X to 12X)" on page 51
- "Typical Micrologic 2.0 A Trip Unit (Long-time Pickup and Delay / Short-time Pickup and Delay)" on page 52
- "Micrologic 2.0/3.0/5.0/6.0 A/P/H Trip Unit Instantaneous Override Values" on page 53

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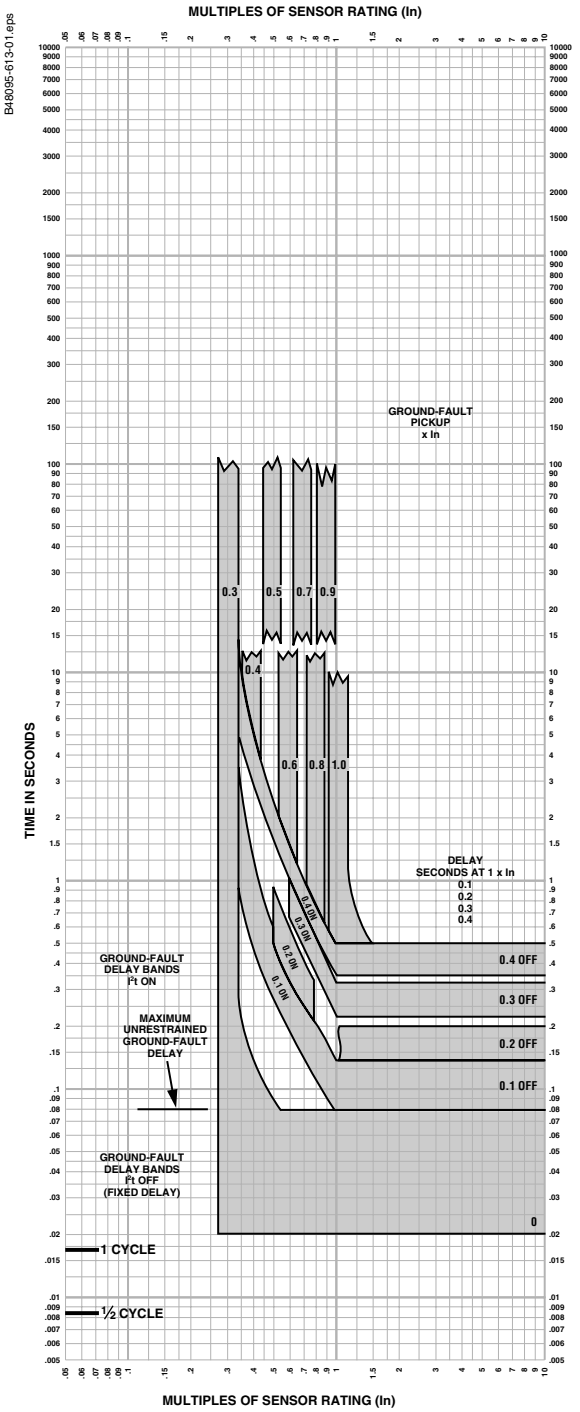
Figure 23: Typical Micrologic 6.0 A/P/H Trip Units with Adjustable Ground-fault Pickup and Delay (Ground Fault I^2t OFF and ON / $I_n \leq 400$ A)



MICROLOGIC 6.0 A/P/H Trip Units with Adjustable Ground-fault Pickup and Delay

Characteristic Trip Curve No. 613-1

Ground Fault I^2t OFF and ON

$I_n \leq 400$ A

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -30°C to +60°C (-22°F to +140°F) ambient temperature.

Curve No. 0613TC0001
Drawing No. B48095-613-01

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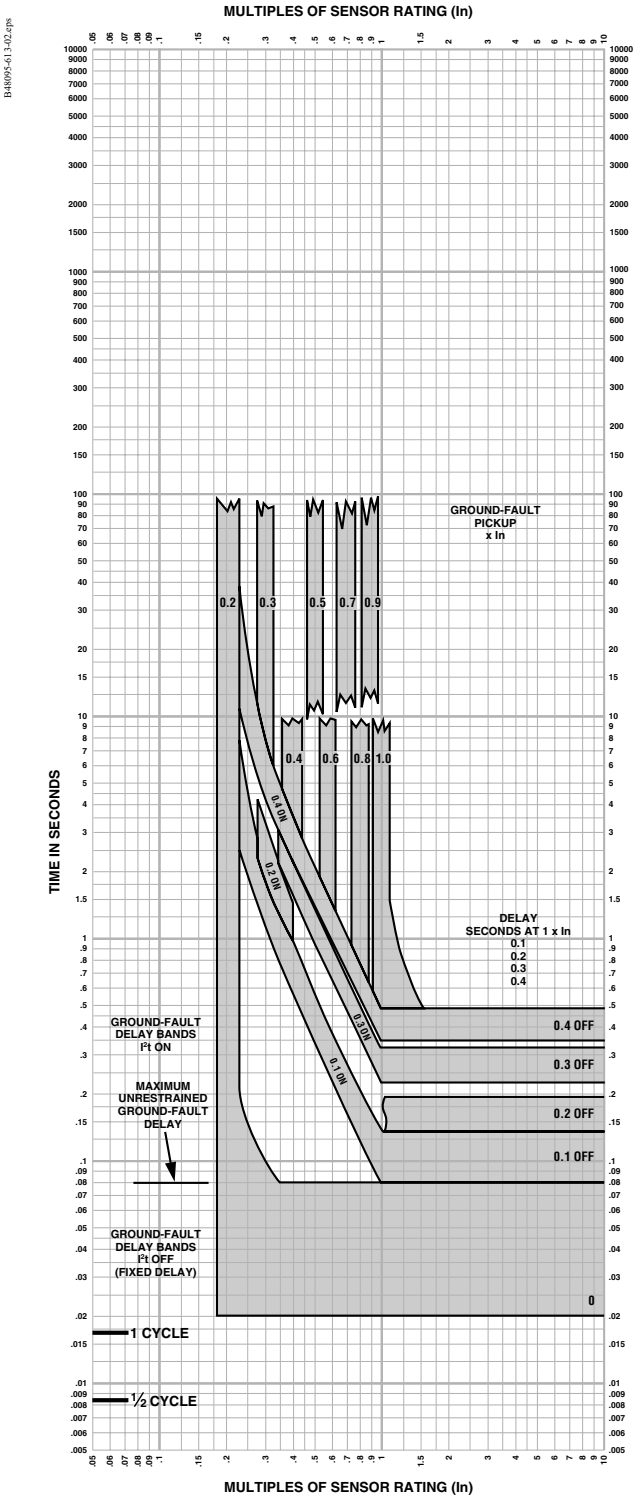
Figure 24: Typical Micrologic 6.0 A/P/H Trip Units with Adjustable Ground-fault Pickup and Delay (Ground Fault I^2t OFF and ON / 400 A < I_n ≤ 1200 A)



Micrologic 6.0 A/P/H Trip Units with Adjustable Ground-fault Pickup and Delay

Characteristic Trip Curve No. 613-2

Ground Fault I^2t OFF and ON

400 A < I_n ≤1200 A

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -30°C to +60°C (-22°F to +140°F) ambient temperature.

Curve No. 0613TC0002
Drawing No. B48095-613-02

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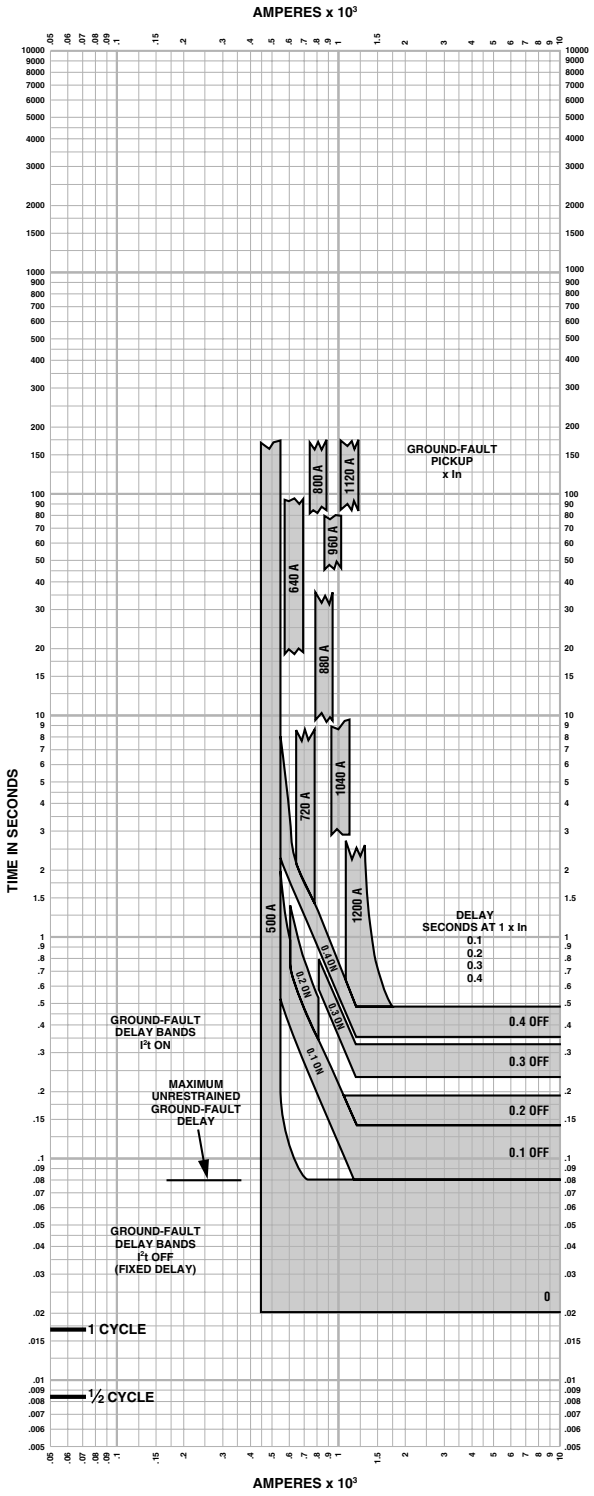
Figure 25: Typical Micrologic 6.0 A/P/H Trip Units with Adjustable Ground-fault Pickup and Delay (Ground fault I^2t OFF and ON / I_n > 1200A)

B48095-613-03.eps



Micrologic 6.0 A/P/H Trip Units with Adjustable Ground-fault Pickup and Delay

Characteristic Trip Curve No. 613-3

Ground Fault I^2t OFF and ON

I_n > 1200 A

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -30°C to +60°C (-22°F to +140°F) ambient temperature.

Curve No. 0613TC0003
Drawing No. B48095-613-03

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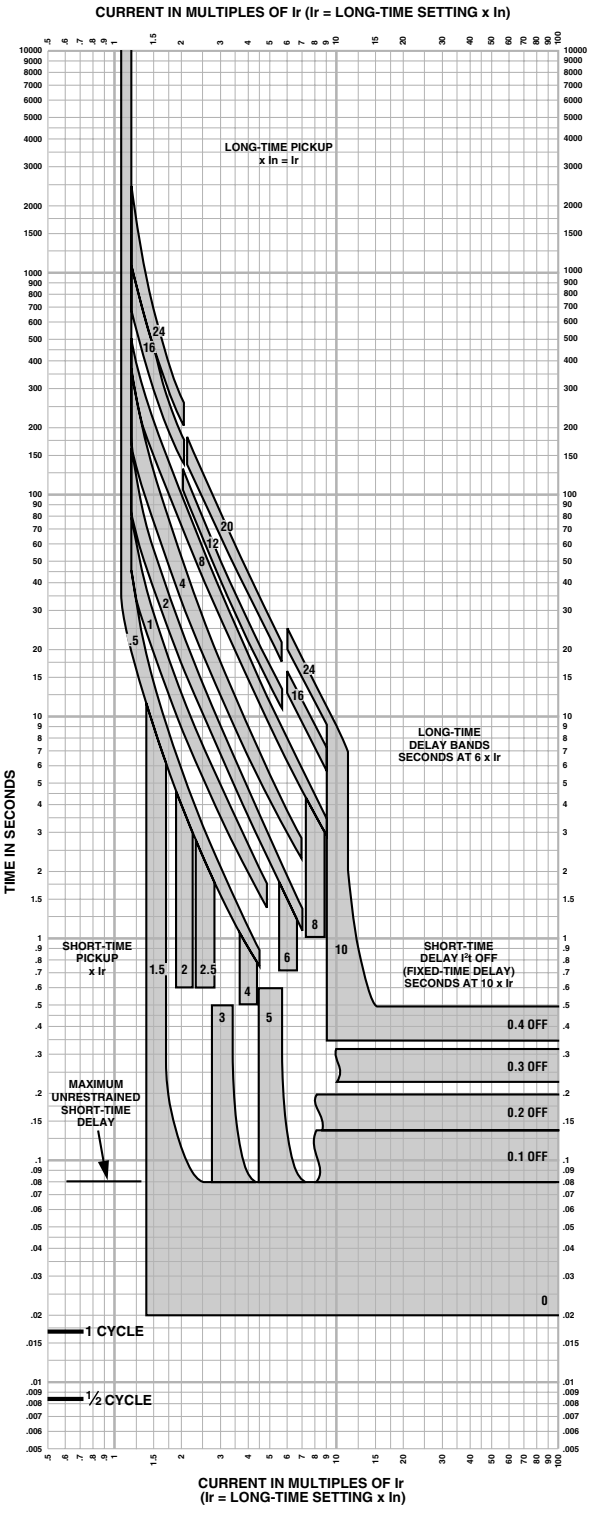
Figure 26: Typical Micrologic 5.0/6.0 A/P/H Trip Units (Long-time Pickup and Delay / Short-time Pickup and I^2t OFF Delay)



Curve No. 0613TC0004
Drawing No. B48095-613-04

Micrologic 5.0/6.0 A/P/H Trip Units

Characteristic Trip Curve No. 613-4

Long-time Pickup and Delay
Short-time Pickup and I^2t OFF Delay

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -30°C to +60°C (-22°F to +140°F) ambient temperature.

NOTE:

1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately twenty minutes is required between overloads to completely reset thermal-imaging.
2. The end of the curve is determined by the interrupting rating of the circuit breaker.
3. With zone-selective interlocking ON, short-time delay utilized, and no restraining signal, the maximum unrestrained short-time delay time band applies regardless of the setting.
4. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of the current.
5. For a withstand circuit breaker, instantaneous can be turned OFF. See trip curve 613-7 for instantaneous trip curve. See trip curve 613-10 for instantaneous override values.
6. Overload indicator illuminates at 100%.

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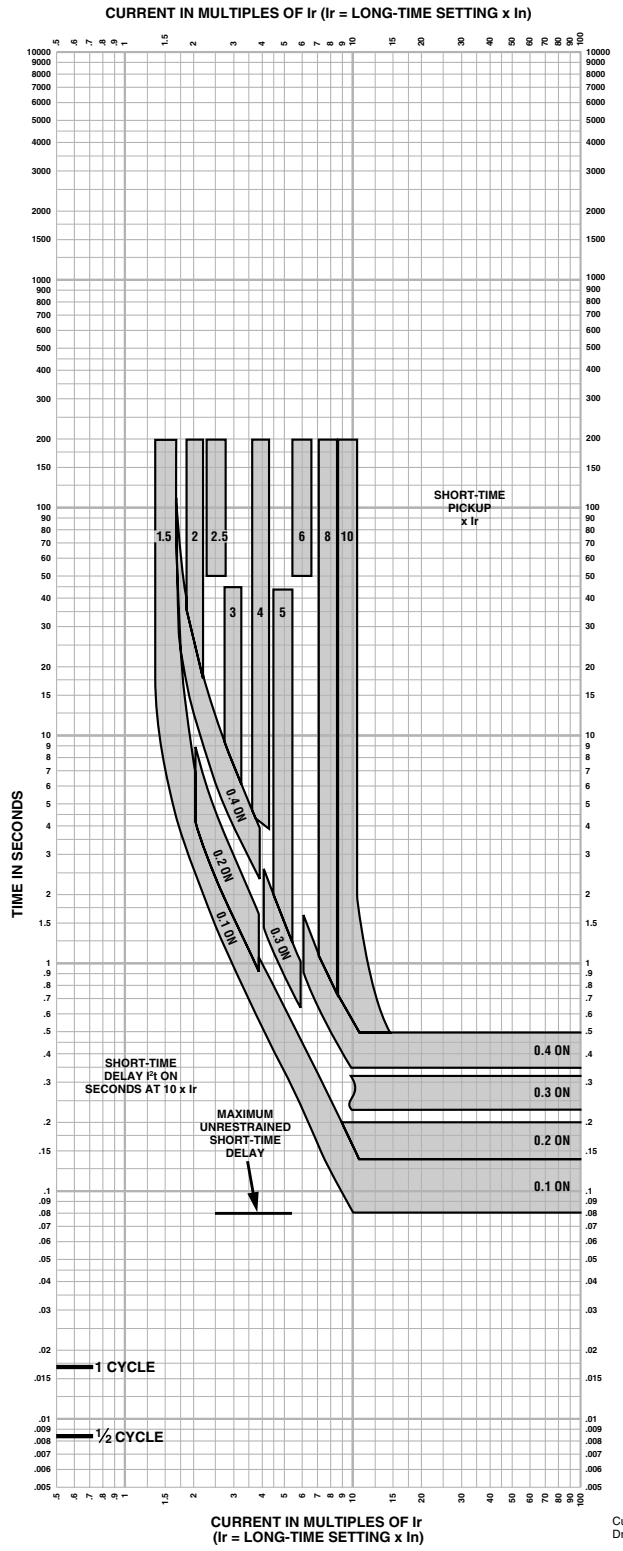
Figure 27: Typical Micrologic 5.0/6.0 A/P/H Trip Units (Short-time Pickup and I^2t ON Delay)



Micrologic 5.0/6.0 A/P/H Trip Units

Characteristic Trip Curve No. 613-5

Short-time Pickup and I^2t ON Delay

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -30°C to +60°C (-22°F to +140°F) ambient temperature.

NOTE:

1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately twenty minutes is required between overloads to completely reset thermal-imaging.
2. The end of the curve is determined by the interrupting rating of the circuit breaker.
3. With zone-selective interlocking ON, short-time delay utilized, and no restraining signal, the maximum unrestrained short-time delay time band applies regardless of the setting.
4. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
5. For withstand circuit breaker, instantaneous can be turned OFF. See trip curve 613-7 for instantaneous trip curve. See trip curve 613-10 for instantaneous override values.
6. See Trip Curve 613-4 for long-time pickup and delay trip curve.

Curve No. 0613TC0005
Drawing No. B48095-613-05

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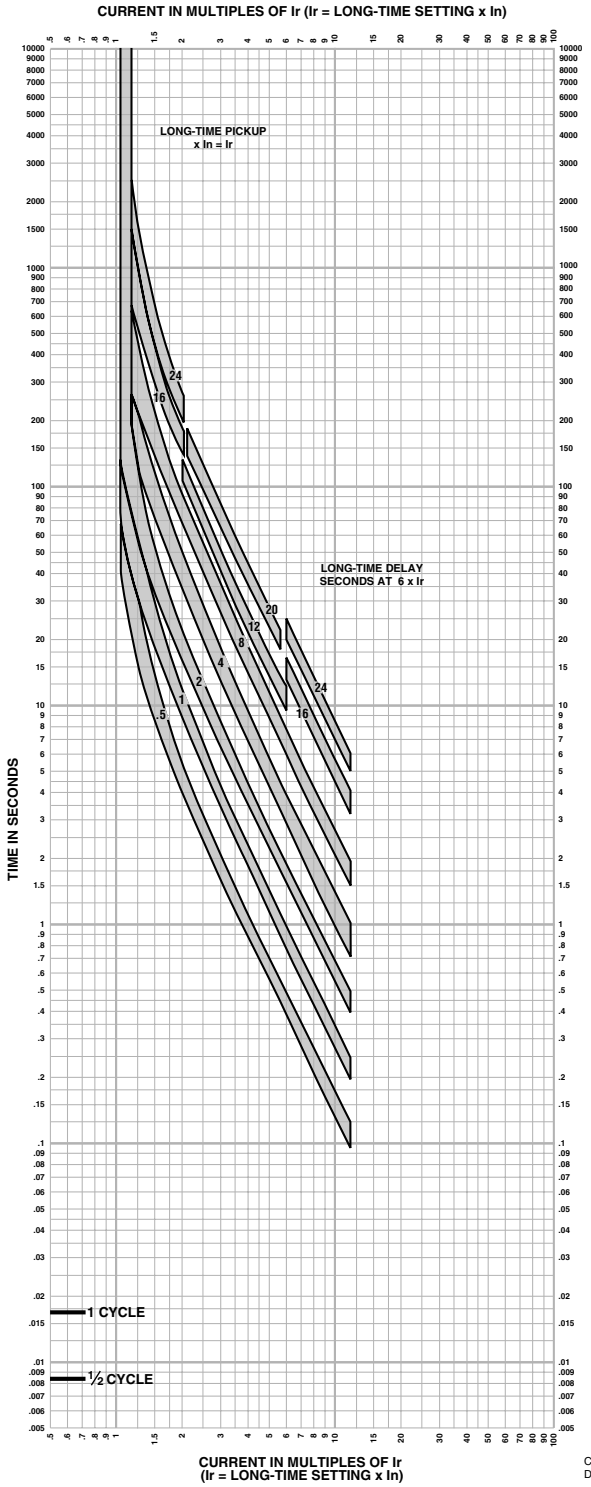
Figure 28: Typical Micrologic 3.0 A Trip Unit (Long-time Pickup and Delay)



Curve No. 0613TC0006
Drawing No. B48095-613-06

Micrologic 3.0A Trip Unit

Characteristic Trip Curve No. 613-6

Long-time Pickup and Delay

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -30°C to +60°C (-22°F to +140°F) ambient temperature.

NOTE:

1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately twenty minutes is required between overloads to completely reset thermal-imaging.
2. The end of the curve is determined by the instantaneous setting of the circuit breaker.
3. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
4. See trip curve 613-8 for instantaneous pickup trip curve.

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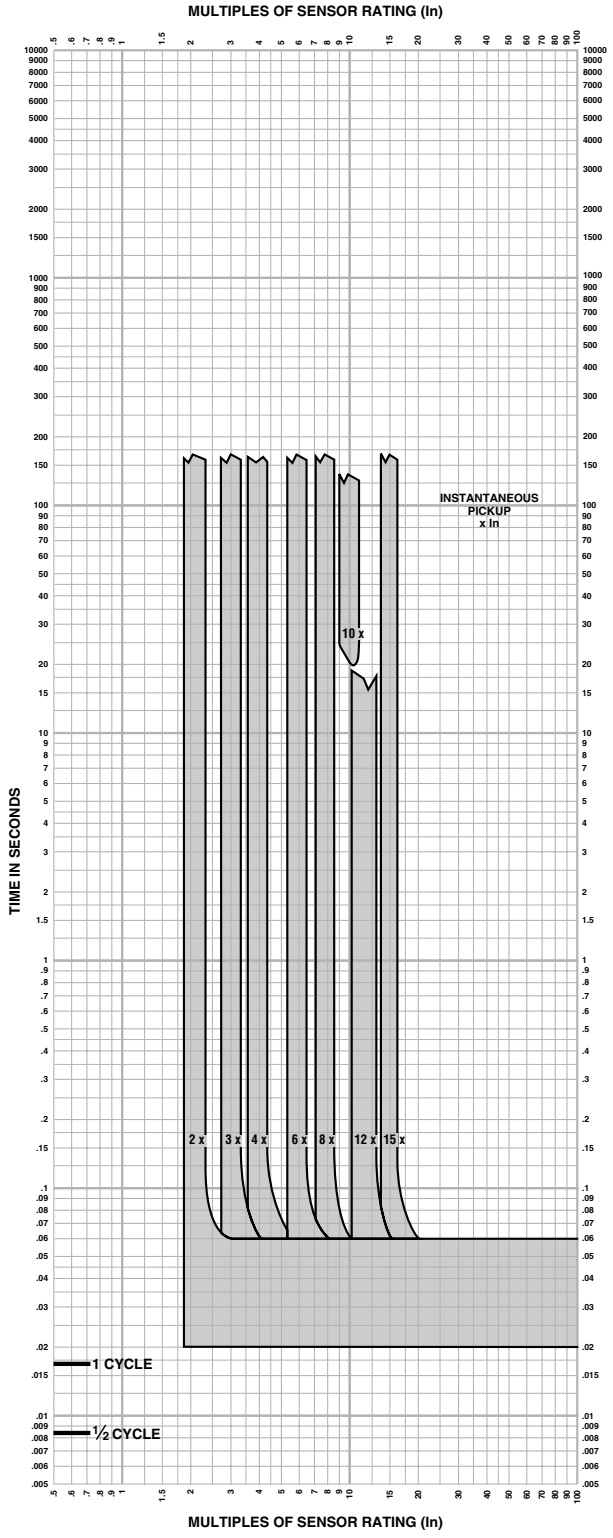
Figure 29: Typical Micrologic 5.0/6.0 Trip Units (instantaneous Pickup, 2X to 15X and OFF)



Curve No. 0613TC0007
Drawing No. B48095-613-07

Micrologic 5.0/6.0 Trip Units

Characteristic Trip Curve No. 613-7

Instantaneous Pickup, 2X to 15X and OFF

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -30°C to +60°C (-22°F to +140°F) ambient temperature.

NOTE:

1. The end of the curve is determined by the interrupting rating of the circuit breaker.
2. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
3. The instantaneous region of the trip curve shows maximum total clearing times. Actual clearing times in this region can vary depending on the circuit breaker mechanism design and other factors. The actual clearing time can be considerably faster than indicated. Contact your local sales office for additional information.
4. For a withstand circuit breaker, instantaneous can be turned OFF. See trip curve 613-7 for the instantaneous trip curve. See trip curve 613-10 for the instantaneous override values.
5. See trip curve 613-4 and trip curve 613-5 for long-time pickup, long-time delay, short-time pickup and short-time delay trip curves.

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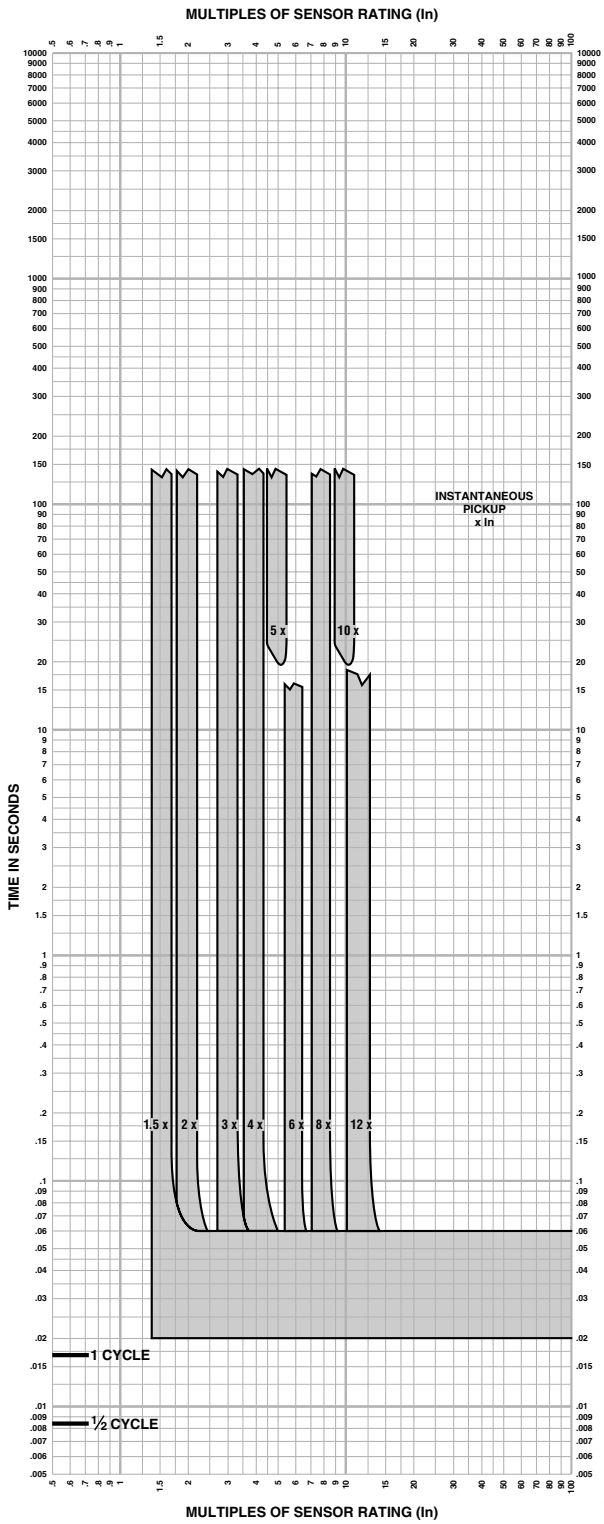
Figure 30: Typical Micrologic 3.0 A Trip Unit (Instantaneous Pickup, 1.5X to 12X)



Curve No. 0613TC0008
Drawing No. B48095-613-08

Micrologic 3.0A Trip Unit

Characteristic Trip Curve No. 613-8

Instantaneous Pickup, 1.5X to 12X

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -30°C to +60°C (-22°F to +140°F) ambient temperature.

NOTE:

1. The end of the curve is determined by the interrupting rating of the circuit breaker.
2. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
3. The instantaneous region of the trip curve shows maximum total clearing times. Actual clearing times in this region can vary depending on the circuit breaker mechanism design and other factors. The actual clearing time can be considerably faster than indicated. Contact your local sales office for additional information.
4. See trip curve 613-6 for long-time pickup and delay trip curves.

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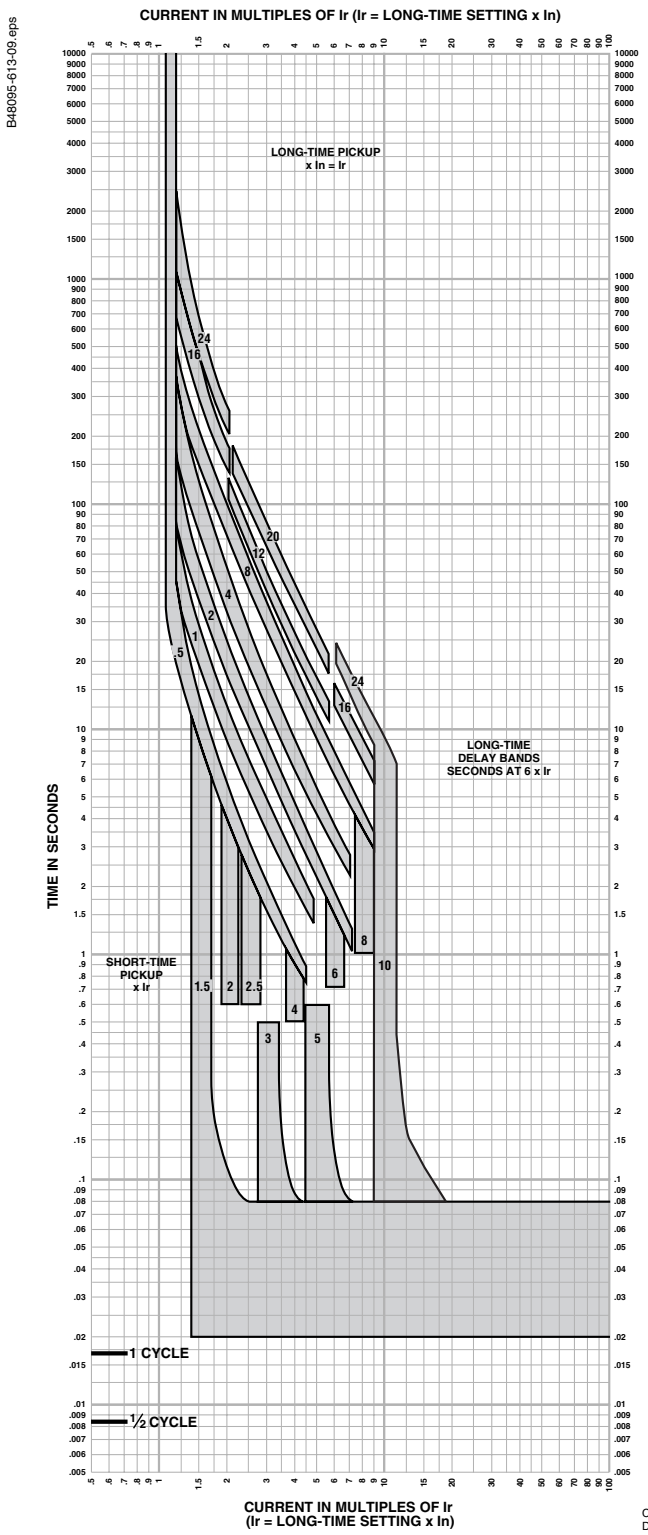
Figure 31: Typical Micrologic 2.0 A Trip Unit (Long-time Pickup and Delay / Short-time Pickup and Delay)



Micrologic 2.0A Trip Unit

Characteristic Trip Curve No. 613-9

Long-time Pickup and Delay
Short-time Pickup with No Delay

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -30°C to +60°C (-22°F to +140°F) ambient temperature.

NOTE:

1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately twenty minutes is required between overloads to completely reset thermal-imaging.
2. The end of the curve is determined by the short-time setting.
3. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
4. Overload indicator illuminates at 100%.

Curve No. 0613TC0009
Drawing No. B48095-613-09

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Figure 32: Micrologic 2.0/3.0/5.0/6.0 A/P/H Trip Unit Instantaneous Override Values

MASTERPACT NW/NT

ANSI CB Model No.	Inst. Override (kA RMS) +/- 10%
NW08N1 ★	24
NW08N1	None
NW16N1	None
NW08H1 ★	24
NW08H1	None
NW16H1	None
NW20H1	None
NW32H1	None
NW08H2 ★	24
NW08H2	None
NW16H2	None
NW20H2	None
NW32H2	None
NW40H2	None
NW50H2	None
NW08H3 ★	24
NW08H3	85
NW16H3	85
NW20H3	85
NW32H3	85
NW40H3	85
NW50H3	85
NW08L1 ★	24
NW08L1	35
NW08L1F	24
NW16L1	35
NW16L1F	24
NW20L1	35
NW20L1F	24
NW32L1	117
NW40L1	117
NW50L1	117
NT08N1 ★	24

★ Maximum sensor plug 250 A

Note:

Faults at or above instantaneous override value will be cleared at 20 msec or less.

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Selection Tables with Transformer Ratings

Transformer ratings for Masterpact NW circuit breakers in Power-Zone 4 switchgear are listed below.

Table 6: Application of Masterpact NW Circuit Breakers (with Standard Three-Phase Transformers: Liquid Filled and Ventilated Dry Types)

Transformer Base (100%) Rating		Secondary Short-Circuit Currents RMS Symmetrical Amperes				Minimum Size Circuit Breakers for Selective Trip Systems		
kVA and Percent Impedance	Amperes [a]	Max. Short-circuit kVA Available from Primary System	Through Transformer Only	Motor Contribution	Combined	Main Circuit Breaker Short-time Delay Trip	Feeder Circuit Breaker Short-time Delay Trip	Feeder Circuit Breaker Instantaneous Trip
208 V Three-Phase - 50% Motor Load / xd'' = 25%[b]								
300 5.0%	833	50000	14900	1700	16600	NW16N1	NW08N1	NW08N1
		100000	15700		17400		NW08N1	NW08N1
		150000	16000		17700		NW08N1	NW08N1
		250000	16300		18000		NW08N1	NW08N1
		500000	16500		18200		NW08N1	NW08N1
		Unlimited	16700		18400		NW08N1	NW08N1
							NT08N1	NT08N1
500 5.0%	1389	50000	23100	2800	25900	NW16N1[c]	NW08N1	NW08N1
		100000	25200		28000		NW08N1	NW08N1
		150000	26000		28800		NW08N1	NW08N1
		250000	26700		29500		NW08N1	NW08N1
		500000	27200		30000		NW08N1	NW08N1
		Unlimited	27800		30600		NW08H1	NW08H1
							NT08N1	NT08N1
750 5.75%	2083	50000	28700	4200	32900	NW32H1	NW08N1	NW08N1
		100000	32000		36200		NW08N1	NW08N1
		150000	33300		37500		NW08N1	NW08N1
		250000	34400		38600		NW08N1	NW08N1
		500000	35200		39400		NW08N1	NW08N1
		Unlimited	36200		40400		NW08N1	NW08N1
							NT08N1	NT08N1
1000 5.75%	2778	50000	35900	5600	41500	N32H1[c]	NW08N1	NW08N1
							NT08N1	NT08N1
1000 5.75%	2778	100000	41200	5600	46800	NW32H1[c]	NW08H1	NW08H1
		150000	43300		48900		NW08H1	NW08H1
		250000	45200		50800		NW08H1	NW08H1
		500000	46700		52300		NW08H1	NW08H1
		Unlimited	48300		53900		NW08H1	NW08H1

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Table 6: Application of Masterpact NW Circuit Breakers (with Standard Three-Phase Transformers: Liquid Filled and Ventilated Dry Types)

Transformer Base (100%) Rating			Secondary Short-Circuit Currents RMS Symmetrical Amperes			Minimum Size Circuit Breakers for Selective Trip Systems		
kVA and Percent Impedance	Amperes [a]	Max. Short-circuit kVA Available from Primary System	Through Transformer Only	Motor Contribution	Combined	Main Circuit Breaker Short-time Delay Trip	Feeder Circuit Breaker Short-time Delay Trip	Feeder Circuit Breaker Instantaneous Trip
240 V Three-Phase - 100% Motor Load / xd'' = 25%[b]								
300 5.0%	722	50000	12900	2900	15800	NW08N1[c]	NW08N1	NW08H1
		100000	13600		16500		NW08N1	NW08H1
		150000	13900		16800		NW08N1	NW08H1
		250000	14100		17000		NW08N1	NW08H1
		500000	14300		17200		NW08N1	NW08H1
		Unlimited	14400		17300		NW08N1	NW08H1
							NT08N1	NT08N1
500 5.0%	1203	50000	20000	4800	24800	NW16N1[c]	NW08N1	NW08N1
		100000	21900		26700		NW08N1	NW08N1
		150000	22500		27300		NW08N1	NW08N1
		250000	23100		27900		NW08N1	NW08N1
		500000	23600		28400		NW08N1	NW08N1
		Unlimited	24100		28900		NW08N1	NW08N1
							NT08N1	NT08N1
750 5.75%	1804	50000	24800	7200	32100	NW20H1[c]	NW08N1	NW08N1
		100000	27800		35000		NW08N1	NW08N1
		150000	28900		36100		NW08N1	NW08N1
		250000	29800		37000		NW08N1	NW08N1
		500000	30600		37800		NW08N1	NW08N1
		Unlimited	31400		38600		NW08N1	NW08N1
							NT08N1	NT08N1
1000 5.75%	2406	50000	31000	9600	40600	N32H1[c]	NW08N1	NW08N1
							NT08N1	NT08N1
1000 5.75%	2406	100000	35600	9600	45200	NW32H1[c]	NW08H1	NW08H1
		150000	37500		47100		NW08H1	NW08H1
		250000	39100		48700		NW08H1	NW08H1
		500000	40400		50000		NW08H1	NW08H1
		Unlimited	41800		51400		NW08H1	NW08H1

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Table 6: Application of Masterpact NW Circuit Breakers (with Standard Three-Phase Transformers: Liquid Filled and Ventilated Dry Types)

Transformer Base (100%) Rating			Secondary Short-Circuit Currents RMS Symmetrical Amperes			Minimum Size Circuit Breakers for Selective Trip Systems		
kVA and Percent Impedance	Amperes [a]	Max. Short-circuit kVA Available from Primary System	Through Transformer Only	Motor Contribution	Combined	Main Circuit Breaker Short-time Delay Trip	Feeder Circuit Breaker Short-time Delay Trip	Feeder Circuit Breaker Instantaneous Trip
480 V Three-Phase - 100% Motor Load / xd" = 25%[b]								
500 5.0%	601	50000	10000	2400	12400	NW08N1[c]	NW08N1	NW08N1
		100000	10900		13300		NW08N1	NW08N1
		150000	11300		13700		NW08N1	NW08N1
		250000	11600		14000		NW08N1	NW08N1
		500000	11800		14200		NW08N1	NW08N1
		Unlimited	12000		14400		NW08N1	NW08N1
							NT08N1	NT08N1
750 5.75%	902	50000	12400	3600	16000	NW16N1	NW08N1	NW08N1
		100000	13900		17500		NW08N1	NW08N1
		150000	14400		18000		NW08N1	NW08N1
		250000	14900		18500		NW08N1	NW08N1
		500000	15300		18900		NW08N1	NW08N1
		Unlimited	15700		19300		NW08N1	NW08N1
							NT08N1	NT08N1
1000 5.75%	1203	50000	15500	4800	20300	NW16N1[c]	NW08N1	NW08N1
		100000	17800		22600		NW08N1	NW08N1
		150000	18700		23500		NW08N1	NW08N1
		250000	19600		24400		NW08N1	NW08N1
		500000	30200		25000		NW08N1	NW08N1
		Unlimited	20900		25700		NW08N1	NW08N1
							NT08N1	NT08N1
1500 5.75%	1804	50000	20600	7200	27800	NW20H1[c]	NW08N1	NW08N1
		100000	24900		32100		NW08N1	NW08N1
		150000	26700		33900		NW08N1	NW08N1
		250000	28400		35600		NW08N1	NW08N1
		500000	29800		37000		NW08N1	NW08N1
		Unlimited	31400		38600		NT08N1	NT08N1
2000 5.75%	2406	50000	24700	9600	34300	NW32H1[c]	NW08N1	NW08N1
		10000	31000		40600		NT08N1	NT08N1
2000 5.75%	2406	150000	34000	9600	43600	NW32H1[c]	NW08H1	NW08H1
		250000	36700		46300		NW08H1	NW08H1
		500000	39100		48700		NW08H1	NW08H1
		Unlimited	41800		51400		NW08H1	NW08H1
2500	3008	50000	28000		40000		NW08N1	NW08N1
							NT08N1	NT08N1
2500 5.75%	3008	50000	28000	12000	40000	NW32H1[c]	NW08H1	NW08H1
		100000	36500		48500		NW08H1	NW08H1
		150000	40500		52500		NW08H1	NW08H1
		250000	44600		56600		NW08H1	NW08H1
		500000	48100		60100		NW08H1	NW08H1
		Unlimited	52300		64300		NW08H1	NW08H1

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Table 6: Application of Masterpact NW Circuit Breakers (with Standard Three-Phase Transformers: Liquid Filled and Ventilated Dry Types)

Transformer Base (100%) Rating			Secondary Short-Circuit Currents RMS Symmetrical Amperes			Minimum Size Circuit Breakers for Selective Trip Systems		
kVA and Percent Impedance	Amperes [a]	Max. Short-circuit kVA Available from Primary System	Through Transformer Only	Motor Contribution	Combined	Main Circuit Breaker Short-time Delay Trip	Feeder Circuit Breaker Short-time Delay Trip	Feeder Circuit Breaker Instantaneous Trip
3000 5.75%	3609	50000	30700	14000	44700	NW40H2[C]	NW08H1	NW08H1
		100000	41200		55200		NW08H1	NW08H1
		150000	46600		60600		NW08H1	NW08H1
		250000	51900		65900		NW08H2	NW08H2
		500000	56800		70800		NW08H2	NW08H2
		Unlimited	62800		76800		NW08H2	NW08H2
3750 5.75%	4511	50000	34000	18000	52000	NW50H2	NW08H1	NW08H1
		100000	47500		65500		NW08H2	NW08H2
		150000	54700		72700		NW08H2	NW08H2
		250000	62200		80200		NW08H2	NW08H2
3750 5.75%	4511	500000	69400	18000	87400	NW50H3	NW08H3	NW08H3
		Unlimited	78500		96500		NW08H3	NW08H3

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Table 6: Application of Masterpact NW Circuit Breakers (with Standard Three-Phase Transformers: Liquid Filled and Ventilated Dry Types)

Transformer Base (100%) Rating			Secondary Short-Circuit Currents RMS Symmetrical Amperes			Minimum Size Circuit Breakers for Selective Trip Systems		
kVA and Percent Impedance	Amperes [a]	Max. Short-circuit kVA Available from Primary System	Through Transformer Only	Motor Contribution	Combined	Main Circuit Breaker Short-time Delay Trip	Feeder Circuit Breaker Short-time Delay Trip	Feeder Circuit Breaker Instantaneous Trip
600 V Three-Phase - 100% Motor Load / xd'' = 25%[b]								
500 5.0%	481	50000	8000	1900	9900	NW08N1	NW08N1	NW08N1
		100000	8700		10600		NW08N1	NW08N1
		150000	9000		10900		NW08N1	NW08N1
		250000	9300		11200		NW08N1	NW08N1
		500000	9400		11300		NW08N1	NW08N1
		Unlimited	9600		11500		NW08N1	NW08N1
750 5.75%	722	50000	10000	2900	12900	NW08N1[c]	NW08N1	NW08N1
		100000	11100		14000		NW08N1	NW08N1
		150000	11600		14500		NW08N1	NW08N1
		250000	11900		14800		NW08N1	NW08N1
		500000	12200		15100		NW08N1	NW08N1
		Unlimited	12600		15500		NW08N1	NW08N1
1000 5.75%	962	50000	12400	3900	16300	NW16N1	NW08N1	NW08N1
		100000	14300		18200		NW08N1	NW08N1
		150000	15000		18900		NW08N1	NW08N1
		250000	15600		19500		NW08N1	NW08N1
		500000	16200		30100		NW08N1	NW08N1
		Unlimited	16700		20600		NW08N1	NW08N1
1500 5.75%	1443	50000	16500	5800	22300	NW16N1[c]	NW08N1	NW08N1
		100000	20000		25800		NW08N1	NW08N1
		150000	21400		27200		NW08N1	NW08N1
		250000	22700		28500		NW08N1	NW08N1
		500000	23900		29700		NW08N1	NW08N1
		Unlimited	25100		30900			
2000 5.75%	1924	50000	19700	7700	27400	NW20H1[c]	NW08N1	NW08N1
		100000	24800		32500		NW08N1	NW08N1
		150000	27200		34900		NW08N1	NW08N1
		250000	29400		37100		NW08N1	NW08N1
		500000	31300		39000		NW08N1	NW08N1
		Unlimited	33500		41200		NW08N1	NW08N1
2500 5.75%	2406	50000	22400	9600	32000	NW32H1[c]	NW08N1	NW08N1
		100000	29200		38800		NW08N1	NW08N1
		150000	32400		42000		NW08N1	NW08N1
		250000	35600		45200		NW08H1	NW08H1
		500000	38500		48100		NW08H1	NW08H1
		Unlimited	41800		51400		NW08H1	NW08H1
3000 5.75%	2886	50000	24600	11500	36100	NW32H1[c]	NW08N1	NW08N1
		100000	33000		44500		NW08H1	NW08H1
		150000	37300		48800		NW08H1	NW08H1
		250000	41500		53000		NW08H1	NW08H1
		500000	45500		57000		NW08H1	NW08H1
		Unlimited	50200		61700		NW08H1	NW08H1

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Table 6: Application of Masterpact NW Circuit Breakers (with Standard Three-Phase Transformers: Liquid Filled and Ventilated Dry Types)

Transformer Base (100%) Rating			Secondary Short-Circuit Currents RMS Symmetrical Amperes			Minimum Size Circuit Breakers for Selective Trip Systems		
kVA and Percent Impedance	Amperes [a]	Max. Short-circuit kVA Available from Primary System	Through Transformer Only	Motor Contribution	Combined	Main Circuit Breaker Short-time Delay Trip	Feeder Circuit Breaker Short-time Delay Trip	Feeder Circuit Breaker Instantaneous Trip
3750 5.75%	3608	50000	27200	14400	41600	NW40H2[C]	NW08N1	NW08N1
		100000	38000		52400		NW08H1	NW08H1
		150000	43700		58100		NW08H1	NW08H1
		250000	49800		64200		NW08H1	NW08H1
		500000	55500		69900		NW08H2	NW08H2
		Unlimited	62800		77200		NW08H2	NW08H2

[a] At transformer base rating.

[b] Subtransient reactance.

[c] Next larger frame size main circuit breaker may be required for 55/65 ×C rise and/or forced air–cooled (FA) transformer. Check Transformer Secondary Ampere Rating.

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Distribution Systems

This section contains a brief overview of Wye and Delta distribution systems.

Wye Solidly Grounded Systems

A Wye system is the most common type of three-phase distribution system for low voltage switchgear. Wye systems are either three- or four-wire distribution systems that are grounded, either in the equipment (see “Four-Wire Wye Distribution—Solidly Grounded System - 3 phase, 4 wire”), or at the transformer source (see “Three-Wire Wye Distribution—Solidly Grounded System - 3 phase, 3 wire”).

Figure 33: Four-Wire Wye Distribution—Solidly Grounded System - 3 phase, 4 wire

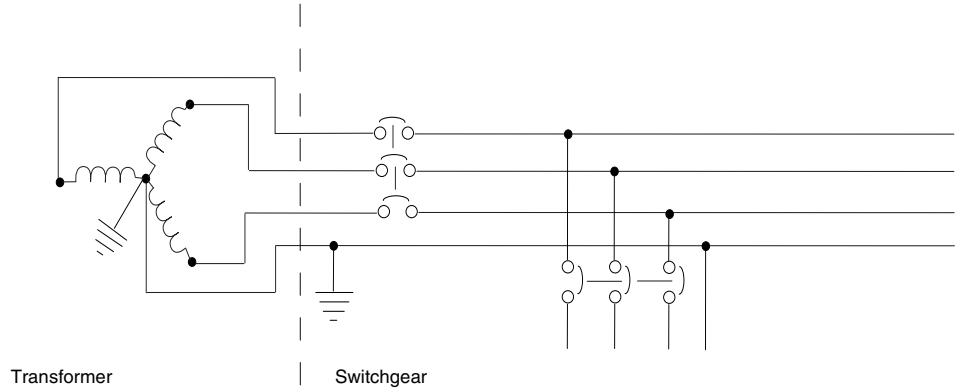
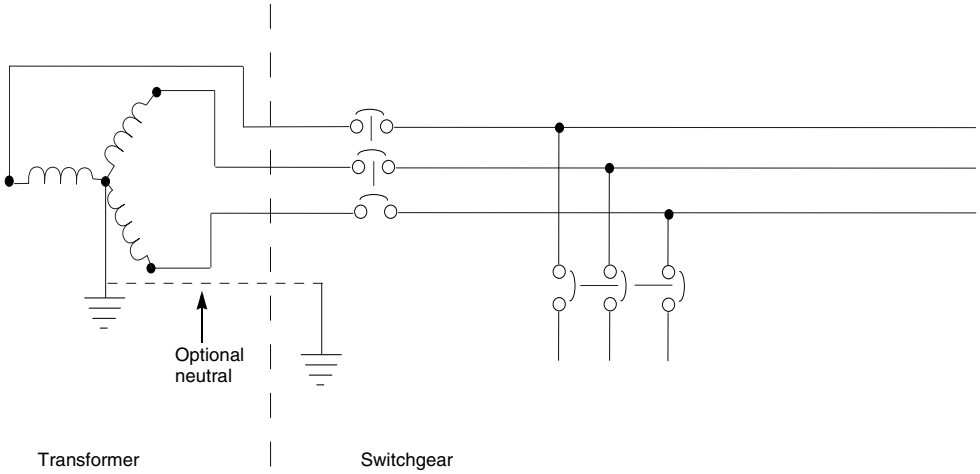


Figure 34: Three-Wire Wye Distribution—Solidly Grounded System - 3 phase, 3 wire



When the system is grounded in the equipment and the neutral phase is carried through the equipment, the system is described as a four-wire solidly grounded system with neutral connections available to supply single phase-to-neutral loads, such as lighting loads.

When the system is grounded at the transformer source and no neutral phase is carried through the equipment, the system is described as a three-wire solidly grounded system. No neutral connections are available; all loads must be three-phase (or single “phase-to-phase”) loads.

In some cases, the neutral is delivered to the service entrance where it is bonded to ground similar to the four-wire solidly grounded system.

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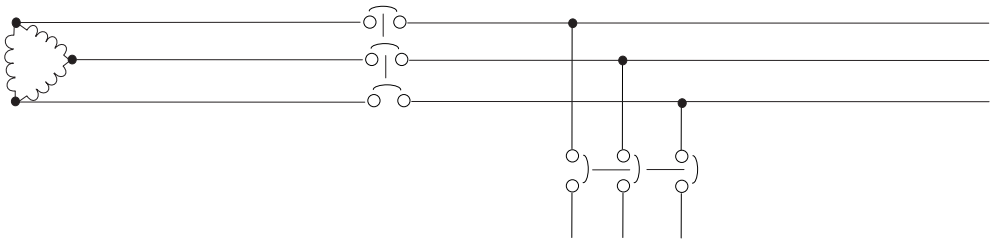
Delta Grounded and Ungrounded Systems

Formerly common, Delta three-wire systems are rarely used in low voltage distribution systems. Delta three-wire distribution systems can be grounded or ungrounded services. Generally, Delta systems are ungrounded. In some cases, they are grounded on the “corner” of the delta or some other point. Ungrounded Delta systems do not have a reference point or ground. Corner or Grounded B Phase Delta distribution systems do provide a reference point but require one phase to be connected to the ground.

Low voltage drawout switchgear with Masterpact NW and NT circuit breakers is designed and built to ANSI C37.20.1 and is tested for single phase-to-phase faults. They can be applied on “corner” grounded Delta distribution systems. Power-Zone 4 switchgear with Masterpact NW and NT circuit breakers is suited for corner grounded or ungrounded systems.

Figure 35: Three-Wire Delta Distribution—Ungrounded - 3 phase, 3 wire



Although ungrounded systems have been used for many years, they are not recommended in newly designed low voltage distribution systems. Ungrounded power systems may be unstable. High resistance grounded systems as shown on pages 65 and 66 are recommended for use in newly designed low voltage distribution systems.

Ground Fault Protection for Wye Systems

The need for ground fault protection in three-phase solidly grounded Wye systems is due to the possibility of low magnitude ground fault currents. Phase-to-phase faults are of such a large magnitude that overcurrent protection devices (trip units) can operate rapidly and positively to signal the circuit breaker to open. Ground faults can be of a much lower magnitude and require specialized elements in the trip unit for detection.

Power-Zone® 4 switchgear with Masterpact® NW and NT circuit breakers equipped with Micrologic® trip units has the capability of providing ground fault sensing (alarm with no tripping) and ground fault protection (tripping) on three-phase, three-wire and three-phase, four-wire solidly-grounded systems. Masterpact NW and NT circuit breakers can be used for overcurrent protection on ungrounded or resistance grounded systems, but are not suitable for ground fault protection on these systems.

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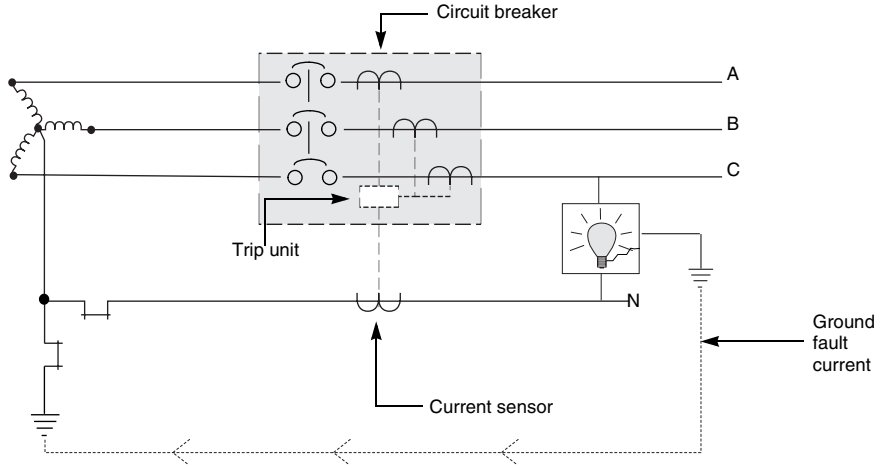
Ground faults are an inadvertent flow of current between the normal current-carrying conductors and ground. These ground faults usually start at a low level and, if left undetected, escalate causing significant heat and mechanical damage to the electrical system. Ground faults can escalate to a phase-to-phase fault causing major system damage. The ground fault system in the Masterpact NW and NT circuit breakers monitors the flow of current in the system and detects ground fault currents. The circuit breaker will trip to protect the circuit, or send an alarm through the appropriate interface equipment, depending on the option installed.

Figure 36: Masterpact NW Circuit Breaker Ground Fault System Sensing Capabilities



The National Electrical Code (NEC) requires ground fault protection on solidly grounded Wye electrical services of more than 150 V to ground, but not exceeding 600 V phase-to-phase for each service disconnect rated 1000 A or more. This includes service entrance, feeders and building disconnects. The NEC also requires ground fault alarm (no tripping) on emergency systems and allows ground fault alarm on continuous processes, fire pumps, and other circuits that would be more hazardous if stopped without an orderly shutdown.

Ground Fault Protection with Tripping

Ground fault protection is available as an option on Masterpact NW and NT circuit breakers with Micrologic 6.0A and higher trip units. Masterpact NW and NT circuit breakers offer three different ground fault sensing options: residual, ground-source return and modified differential. The sensing options make it possible to match the number and location of current sensors to the application. The pickup and delay settings for ground fault are adjustable locally with the dial settings or through the key pad. The pickup and delay settings for ground fault are also adjustable remotely over a computer network on Micrologic 6.0 and higher trip units. A neutral current sensor (NCT) must be installed in the neutral if ground fault alarm is used on a three-phase, four-wire system.

Ground Fault Protection without Tripping

All Masterpact NW and NT circuit breakers with Micrologic 5.0P and higher trip units come standard with the ability to sense and report a ground fault alarm through the optional programmable contact module or communication network. A neutral current sensor (NCT) must be installed in the neutral if ground fault alarm is used on a three-phase, four-wire system.

The pickup and delay settings for the ground fault alarm are adjustable locally through the key pad on the trip unit or remotely over a computer network.

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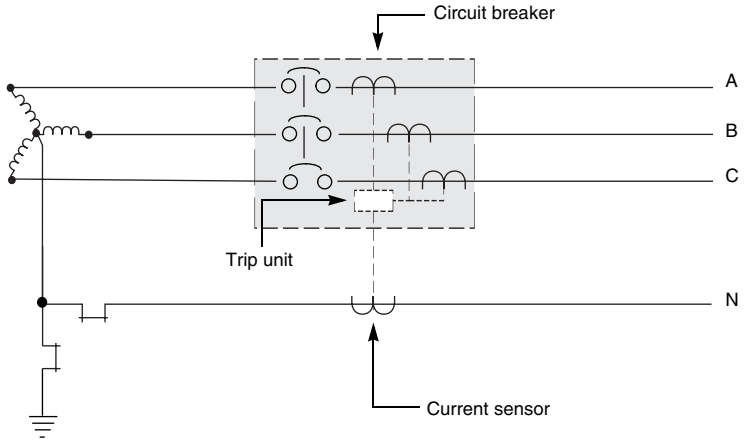
Residual Ground Fault Sensing

Residual ground fault sensing systems use one current sensor for each current-carrying conductor. The trip unit vectorially sums the secondary outputs from each sensor to determine if there is a ground fault and the magnitude of the ground fault. The following diagram shows the current sensors for a three-phase, four-wire system. There is a current sensor on each phase and the neutral.

Figure 37: Typical Residual Ground Fault Sensing System with Phase Conductors

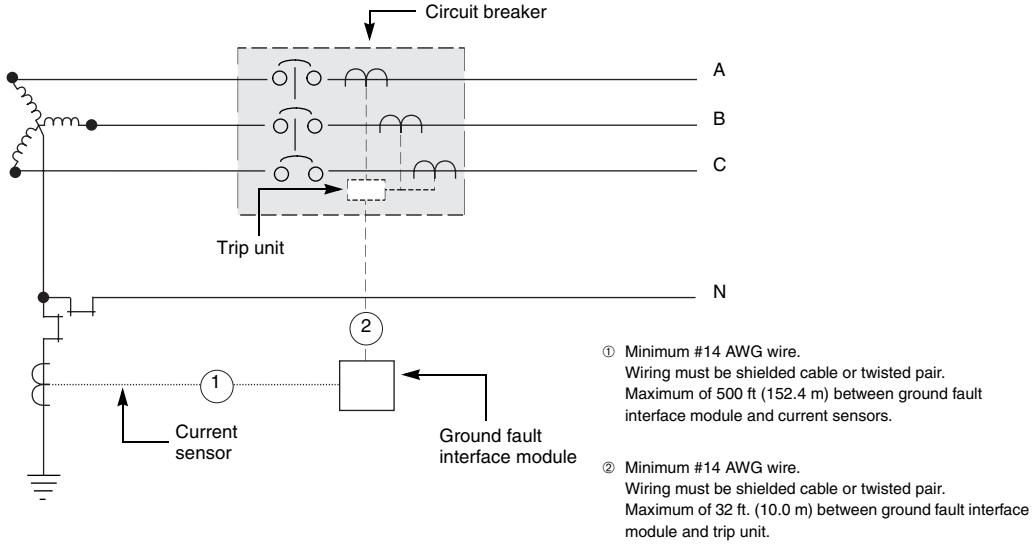


The sensors for the phase conductors A, B and C are inside the circuit breaker. The neutral current transformer is installed in the neutral circuit. If the circuit breaker were used on a three-phase, three-wire system, the neutral current transformer would not be necessary.

Ground Source Return

Ground source return ground fault sensing systems use one current sensor on the ground conductor. The current sensor measures the ground current flow. The following diagram shows the current sensor for a three-phase, four-wire system. Ground source return can also be used on three-phase, three-wire systems.

Figure 38: Typical Ground Source Return Sensing System with Ground Fault Interface Module and Current Sensor



Ground-source return sensing systems require the use of the optional ground fault interface module and a sensor installed in the ground circuit.

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The current sensor and ground fault interface module must be wired per the installation and wiring instructions included with the ground fault interface module.

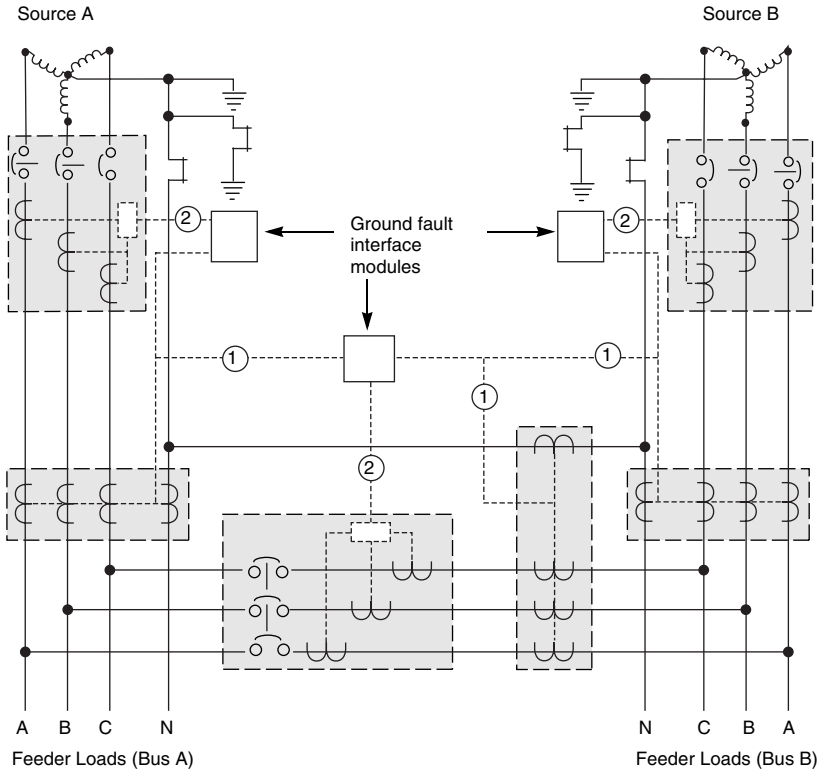
Modified Differential Ground Fault System

A modified differential ground fault system (MDGF) is used for multiple sourced systems. Normal residual and ground-source return systems will not correctly sum all of the circulating currents caused by the multiple neutral paths and multiple grounds. The following diagram shows a typical main-tie-main system. Each source transformer is grounded, and the service entrance neutral is bonded to ground. Multiple neutral paths allow neutral current to circulate and return to the supplying transformer by several different paths. The ground fault system must be capable of correctly summing these circulating currents.

Figure 39: Typical Modified Differential Ground Fault System with Ground Fault Interface Modules

① Minimum #14 AWG wire.
Wiring must be shielded cable or twisted pair.
Maximum of 500 ft (152.4 m) between ground fault interface module and current sensors.

② Minimum #14 AWG wire.
Wiring must be shielded cable or twisted pair.
Maximum of 32 ft. (10.0 m) between ground fault interface module and trip unit.



The modified differential ground fault sensing system requires the use of ground fault interface modules and current sensors installed in all normal current-carrying conductors.

The current sensors and ground fault interface modules must be wired in parallel and the polarity of the current sensors must be maintained per the installation and wiring instructions included with the ground fault interface module.

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High Resistance Grounded Systems

When continuance of service for a distribution system is a high priority, high-resistance grounding adds the features of a grounded system on an ungrounded system, while minimizing the risk of service interruptions resulting from ground faults.

High resistance grounding simultaneously provides a system reference point (or ground) to overcome the negative effects of low level ground faults and limits the magnitude of current that can flow during a ground fault. A resistance value is selected to limit the overvoltage during arcing faults. Industry practice has established that the resistance value should be selected relative to the system capacitive charging current.

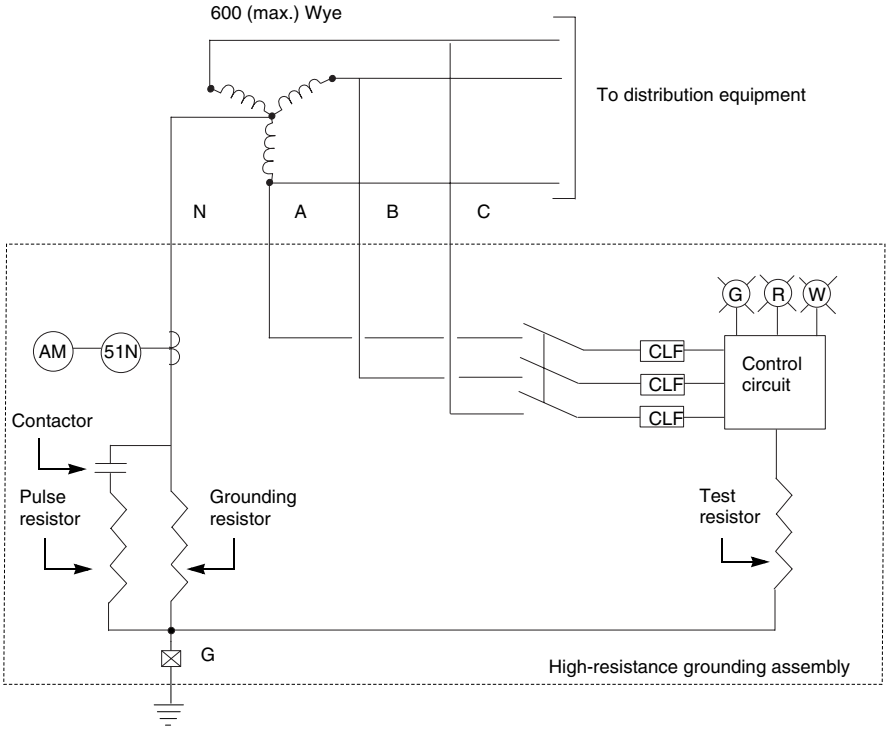
An ammeter, in the circuit of a grounding resistor/grounding transformer assembly, reads the total amount of the ground current flowing through the system. When a current-sensing relay is added, any levels in excess of the capacitive charging current can be monitored. Alternatively, a voltmeter-relay can be connected across ground resistors to monitor the capacitive charging current in a resistor/grounding transformer assembly. The ground current ammeter provides a linear reading of the existent ac ground current present in the system for both the current and voltage detection methods described above.

Circuit breakers rated to C37.13 are recommended for high resistance grounded systems. Power-Zone 4 switchgear with Masterpact NW and NT circuit breakers is rated to C37.13.

Wye Systems Configured

High resistance grounding for Wye-connected systems is established by placing resistors in series with the neutral-to-ground connection of the power source. Grounding resistors are chosen to limit the ground current to a maximum value of five amperes. Line-to-neutral loads cannot be connected to a system where the neutral is resistance-grounded. For additional information, see 2005 NEC 250.36.

Figure 40: Four-Wire Wye System Fault Detection with Current Relay



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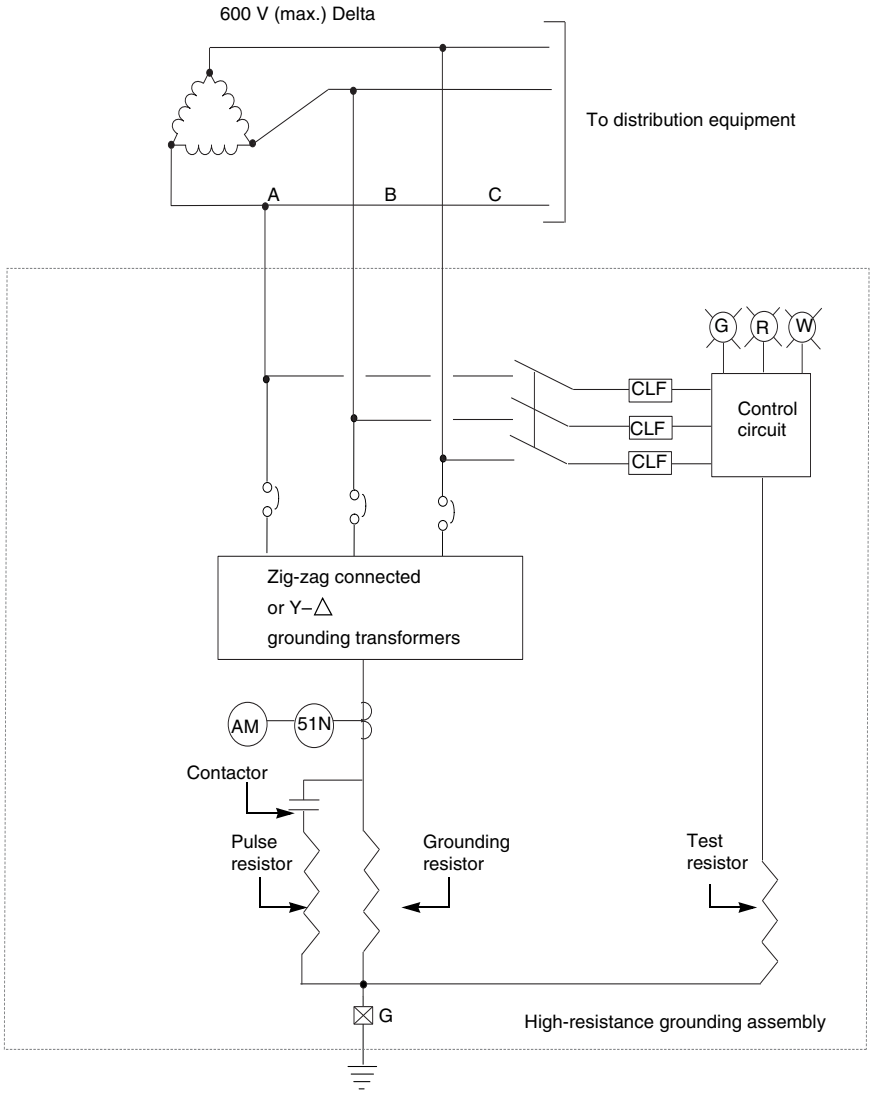
Delta Systems Configured

A neutral point must be established in an ungrounded Delta-connected system using three single-phase transformers. Typically, grounding resistors and transformers are chosen to limit the ground current to a maximum value of five amperes. This technique can be applied on Wye-connected sources when the neutral point is not accessible from the service entrance conduit. The neutral point cannot be used to service phase-to-neutral loads.

Figure 41: Three-Wire Delta System with Zig Zag Grounding Transformers



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Automatic Transfer Systems

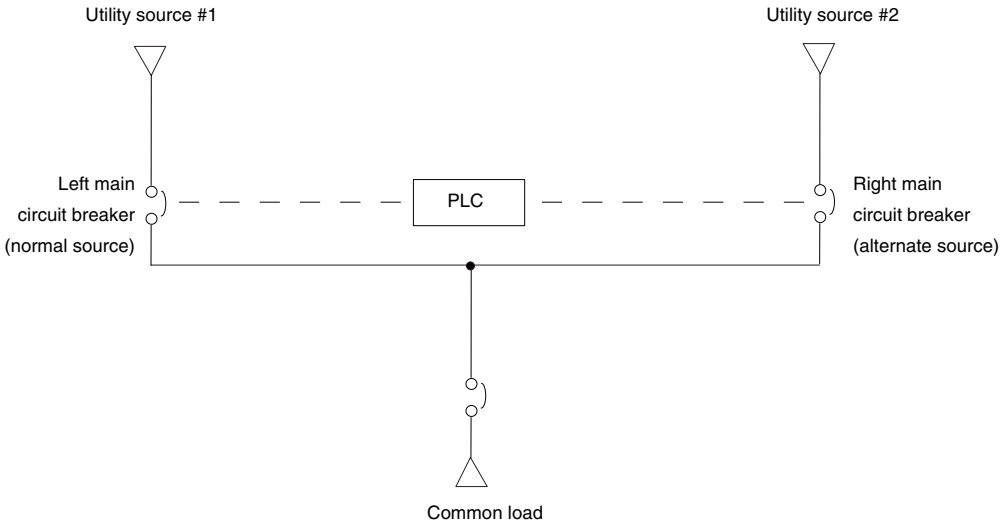
Automatic transfer systems minimize power interruption by transferring the load from the normal source to an alternate source when the normal source is temporarily unavailable. The system uses multiple connections to power sources, usually utility sources, and a programmable logic controller (PLC) to achieve this transfer. These systems also feature redundant supplies of control power. Examples of automatic transfer systems with main-main circuit breakers and main-tie-main circuit breakers are shown in Figure 42: below and Figure 43: on page 68.

Main-Main Circuit Breakers

Each main circuit breaker connects to a utility source. When the normal source becomes unavailable, the system transfers to the alternate. If the system comes equipped with a preferred source selector option, the system reverts to the preferred source automatically once it is available. Without the selector, automatic retransfer does not occur.

Optional listing to UL 1008 for both **closed** and **open** transition transfer schemes is available. When an **open** transition UL 1008 listed transfer scheme is specified, a mechanical interlocking cable is provided between the two main circuit breakers (main-main) to assure that at least one breaker is always open. This way, one circuit breaker is open prior to closing the other main.

Figure 42: Main-Main Circuit Breaker Configuration



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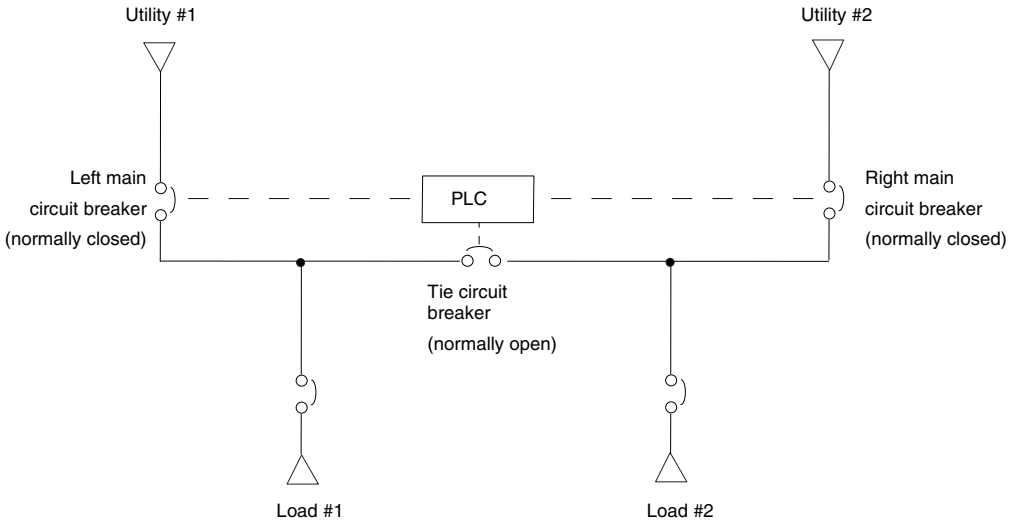
Main-Tie-Main Circuit Breakers

Both main circuit breakers, connected to a utility source, are connected together by means of a normally open tie circuit breaker. Each main circuit breaker feeds independent load buses. Various settings of the preferred source selector switch and the retransfer on/off options determine which circuit breakers are closed during various operating conditions.

Figure 43: Main-Tie-Main Circuit Breaker Configuration



Special Applications

This section contains information regarding low voltage systems in seismic and high altitude applications.

Seismic Applications

Power-Zone 4 switchgear has been tested for applications according to Uniform Building Code (UBC) zone 4 requirements. Equipment must be anchored properly to fully comply with zone 4 installations. Additional information can be found in Bulletin No. 80298-002-05, Power-Zone 4 Low Voltage, Metal-Enclosed, Drawout Switchgear with Masterpact® Low Voltage Power Circuit Breakers.

High Altitude Applications

When Power-Zone 4 switchgear with Masterpact NW and NT circuit breakers is installed at a location greater than 6600 feet above sea level, the ratings must be de-rated.

Altitude	Voltage	Amps
6600 ft (2,000 m) and below	100%	100%
8500 ft (2,600 m)	95%	99%
13000 ft (3,900 m)	80%	96%

NOTE: Ref. ANSI C37.20.1, Table 10.

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SECTION 4 : WIRING DIAGRAMS

SECTION CONTENTS

"Basic Electrically Operated Circuit Breaker Diagrams" 70
"Masterpact NW/NT Alarm and Cradle Contacts" 70
"Masterpact NW/NT Power, Trip Unit, and Remote Operation" 72

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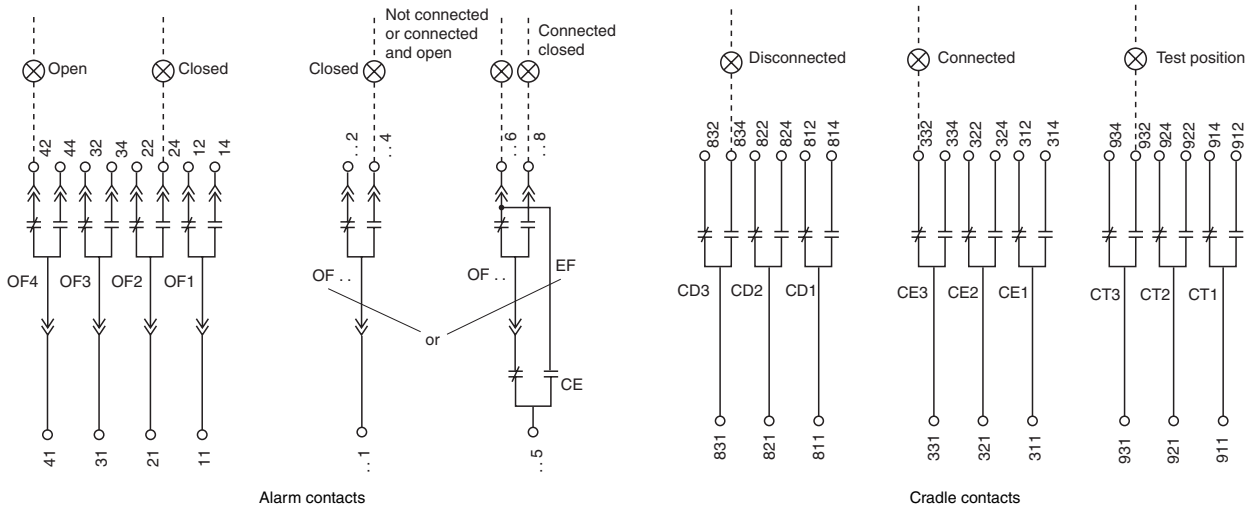
BASIC ELECTRICALLY OPERATED CIRCUIT BREAKER DIAGRAMS

This section contains Masterpact® NW and NT circuit breaker diagrams. Refer to the *Masterpact NT/NW Universal Power Circuit Breakers* catalog for additional information.

Masterpact NW/NT Alarm and Cradle Contacts

Figure 44: Masterpact NW Alarm and Cradle Contacts



OF4	OF3	OF2	OF1
44	34	24	14
42	32	22	12
41	31	21	11

OF24	OF23	OF22	OF21	OF14	OF13	OF12	OF11
244	234	224	214	144	134	124	114
242	232	222	212	142	132	122	112
241	231	221	211	141	131	121	111
OU	OU	OU	OU	OU	OU	OU	OU
OF24	OF23	OF22	OF21	OF14	OF13	OF12	OF11
248	238	228	218	148	138	128	118
246	236	226	216	146	136	126	116
245	235	225	215	145	135	125	115

CD3	CD2	CD1	CE3	CE2	CE1	CT3	CT2	CT1
834	824	814	334	324	314	934	924	914
832	822	812	332	322	312	932	922	912
831	821	811	331	321	311	931	921	911
OU						OU		
CE6	CE5	CE4				CE9	CE8	CE7
364	354	344				394	384	374
362	352	342				392	382	372
361	351	341				391	381	371

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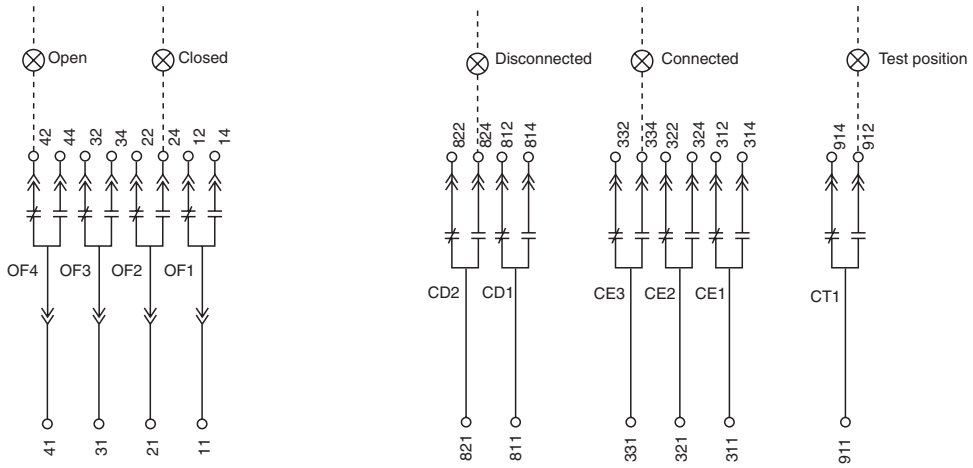
Figure 45: Masterpact NT Alarm and Cradle Contacts



OF4	OF3	OF2	OF1
44	34	24	14
42	32	22	12
41	31	21	11

CD2	CD1	CE3	CE2	CE1	CT1
824	814	334	324	314	914
822	812	332	322	312	912
821	811	331	321	311	911

NW/NT Circuit Breaker Alarm and Cradle Contacts

Table 7: Alarm Contacts

OF4, OF3 OF2, OF1	“Open/close” circuit breaker or switch position contacts	OF24: “Open/close” circuit breaker or switch position contact or EF24: Combined “connected and closed” contact
		OF23 or EF23
		OF22 or EF22
		OF21 or EF21
		OF14 or EF14
		OF13 or EF13
		OF12 or EF12
		OF22 or EF22
		OF11 or EF11

NOTE: OF1, OF2, OF3 and OF4 contacts are standard equipment.

Table 8: Cradle Contacts

CD3, CD2, CD1	“Disconnected” position contacts	CE3, CE2, CE1	“Connected” position contacts	CT3, CT2, CT1	“Test” position contacts
or				or	
CE6, CE5, CE4	“Connected” position contacts			CE9, CE8, CE7	“Connected” position contacts
				or	
				CD6, CD5, CD4	“Disconnected” position contacts

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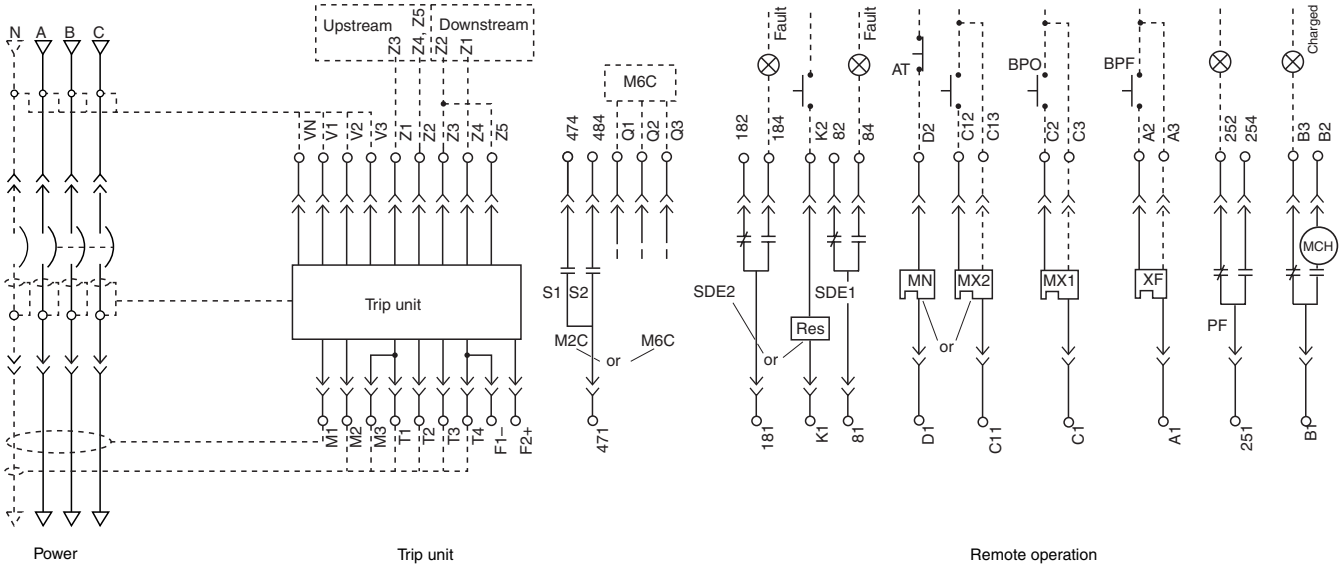
Masterpact NW/NT Power, Trip Unit, and Remote Operation

Figure 46: Masterpact NW Power, Trip Unit, and Remote Operation



COM		UC1		UC2		UC 3			M2C / M6C
E5	E6	Z5	M1	M2	M3	F2+		V3	484 / Q3
E3	E4	Z3	Z4	T3	T4	VN		V2	474 / Q2
E1	E2	Z1	Z2	T1	T2	F1-		V1	471 / Q1

SDE2 / Res	SDE1	MN / MX2	MX1	XF	PF	MCH
184 / K2	84	D2 / C12	C2	A2	254	B2
182 /	82	/	C3	A3	252	B3
181 / K1	81	D1 / C11	C1	A1	251	B1

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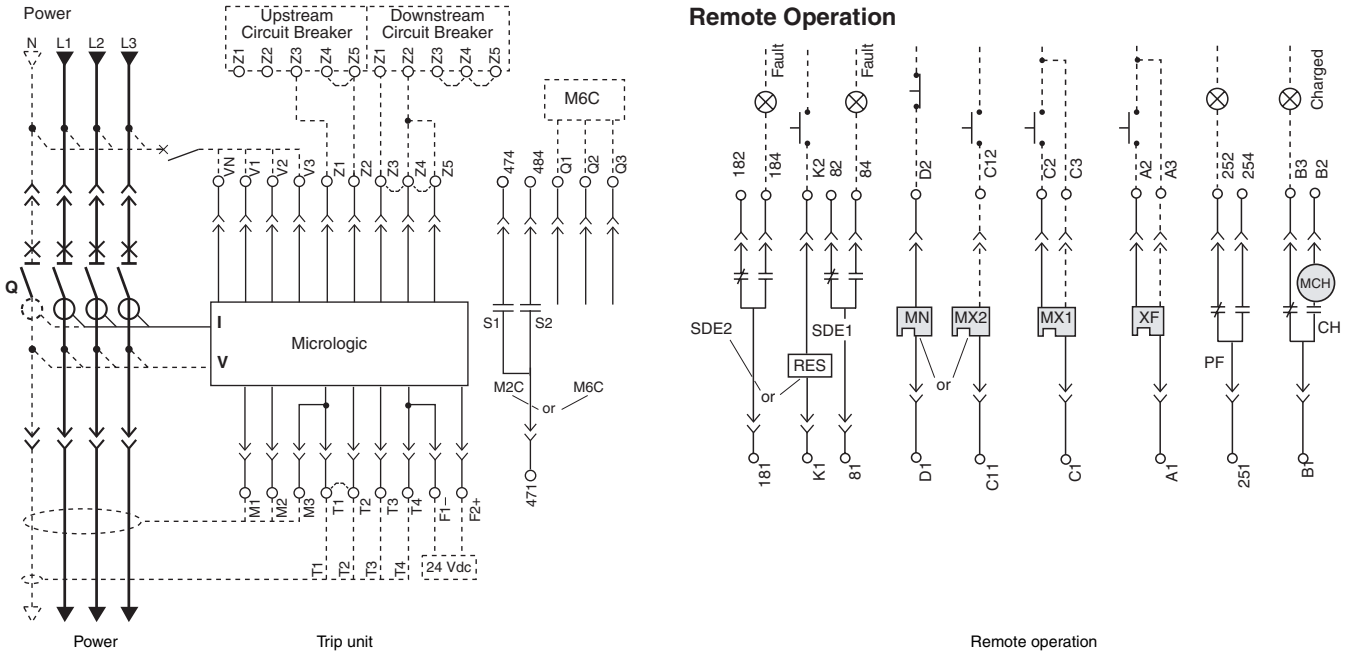
Figure 47: Masterpact NT Power, Trip Unit, and Remote Operation



COM		UC1		UC2		UC3	UC4 / M2C / M6C
E5	E6	Z5	M1	M2	M3	F2+	V3 / 484 / Q3
E3	E4	Z3	Z4	T3	T4	VN	V2 / 474 / Q2
E1	E2	Z1	Z2	T1	T2	F1–	V1 / 471 / Q1

SDE2 / RES	SDE1	MN / MX2	MX1	XF	PF	MCH
184 / K2	84	D2 / C12	C2	A2	254	B2
182	82	C13	C3	A3	252	B3
181 / K1	81	D1 / C11	C1	A1	251	B1

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NW/NT Circuit Breaker Trip Units and Remote Operation

Table 9: Basic A/P/H Trip Units

Basic	A	P	H	Trip Unit	
■	■	■	■	Com:	E1–E6 communication
	■ ■ ■ ■ ■	■ ■ ■ ■ ■	■ ■ ■ ■ ■	UC1:	Z1–Z5 logical selectivity Z1 = ZSI OUT Z2 = ZSI OUT Com; Z3 = ZSI IN Com Z4 = ZSI IN short-time delay Z5 = ZSI IN ground fault
	■	■	■	UC2:	T1, T2, T3, T4 = external neutral;
	■	■ ■	■ ■	UC3:	F2+, F1– 24 Vdc external power supply External neutral VN plug
		■	■	UC4	
		■	■	M2C	Two programmable contacts (internal relay)
		■	■	or M6C	Six programmable contacts (for connection to external M6C module)

Table 10: Remote Operation

SDE2 or Res	Electrical fault alarm contact Remote reset
SDE1	Electrical fault alarm contact (standard or over current trip switch)
MN or MX2	Undervoltage trip device Shunt trip device
MX1	Shunt trip device (standard or networked)
XF	Closing coil (standard or networked)
PF	Ready-to-close contact
MCH	Spring-charging motor

NOTE: When networked MX1 or XF coils are used, the third wire (C3, A3) must be connected even if the communications module is not installed.

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SECTION 5 : DIMENSIONS

SECTION CONTENTS

"Top and Bottom Conduit Entrance Layouts" 76
"System Design" 88
"Weights" 90

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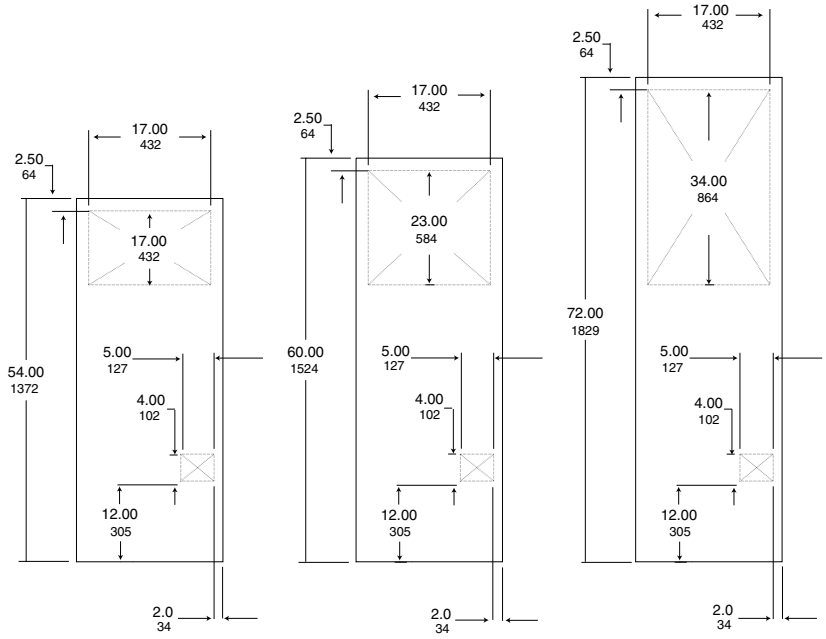
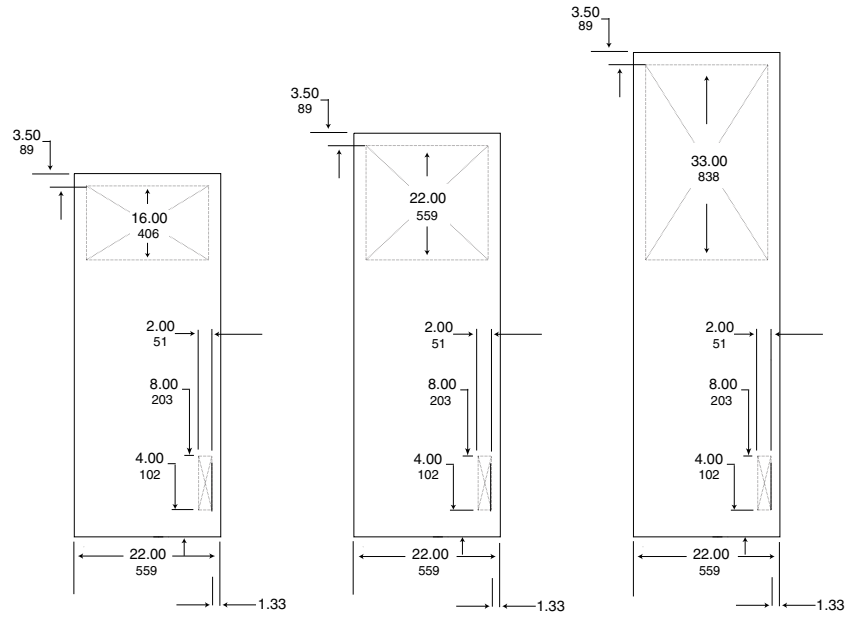
TOP AND BOTTOM CONDUIT ENTRANCE LAYOUTS

Figure 48: Top and Bottom Conduit Entrance Dimensions (22-inch wide)– Not for Construction (consult factory drawings)



Top Conduit Entrance–Auxiliary Section (22-inch wide)



Bottom Conduit Entrance–Auxiliary Section (22-inch wide)

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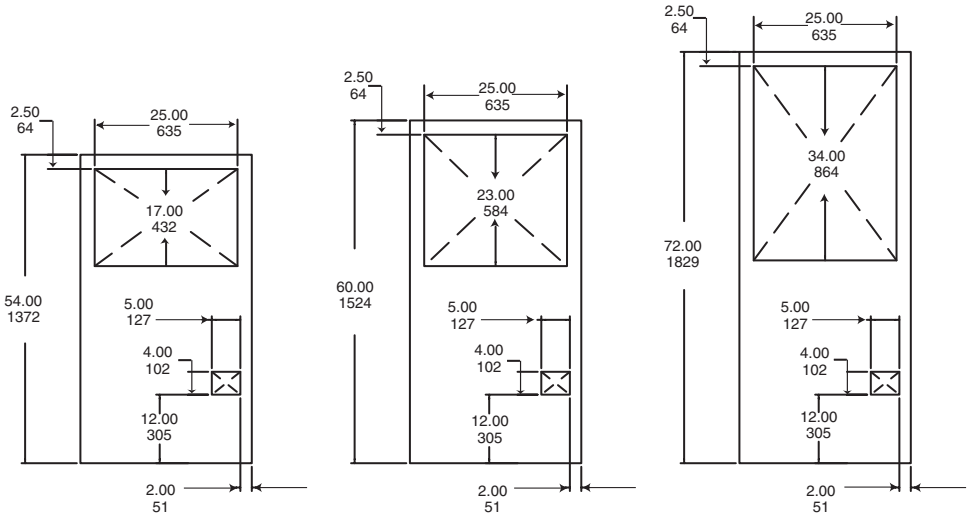
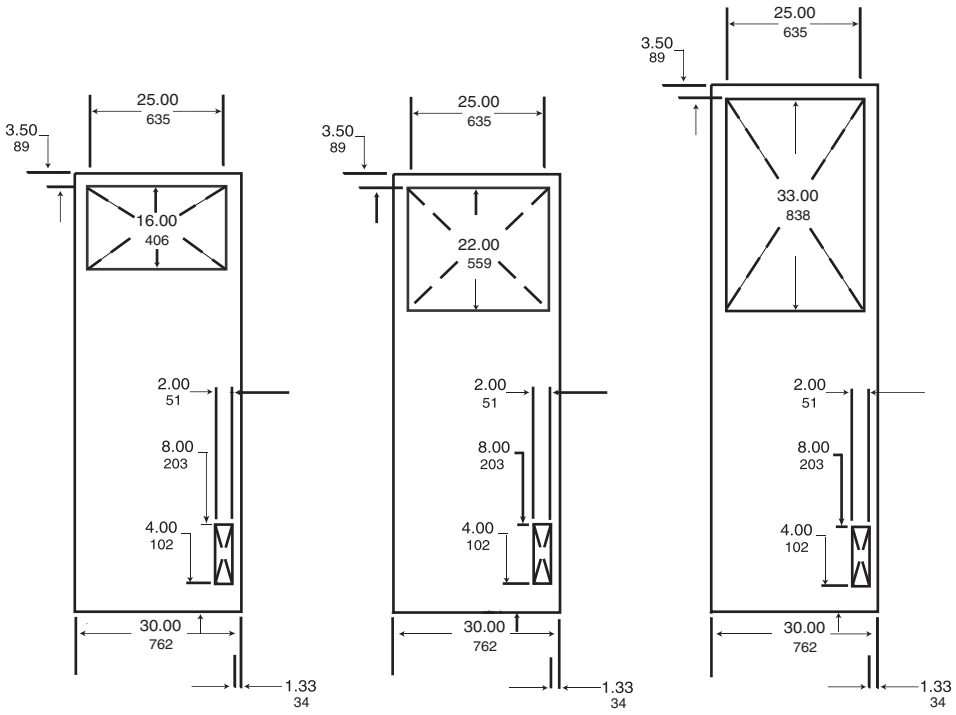
Figure 49: Top and Bottom Conduit Entrance Dimensions (30-inch wide)– Not for Construction (consult factory drawings)



Top Conduit Entrance–Auxiliary Section (30-inch wide)



Bottom Conduit Entrance–Auxiliary Section (30-inch wide)

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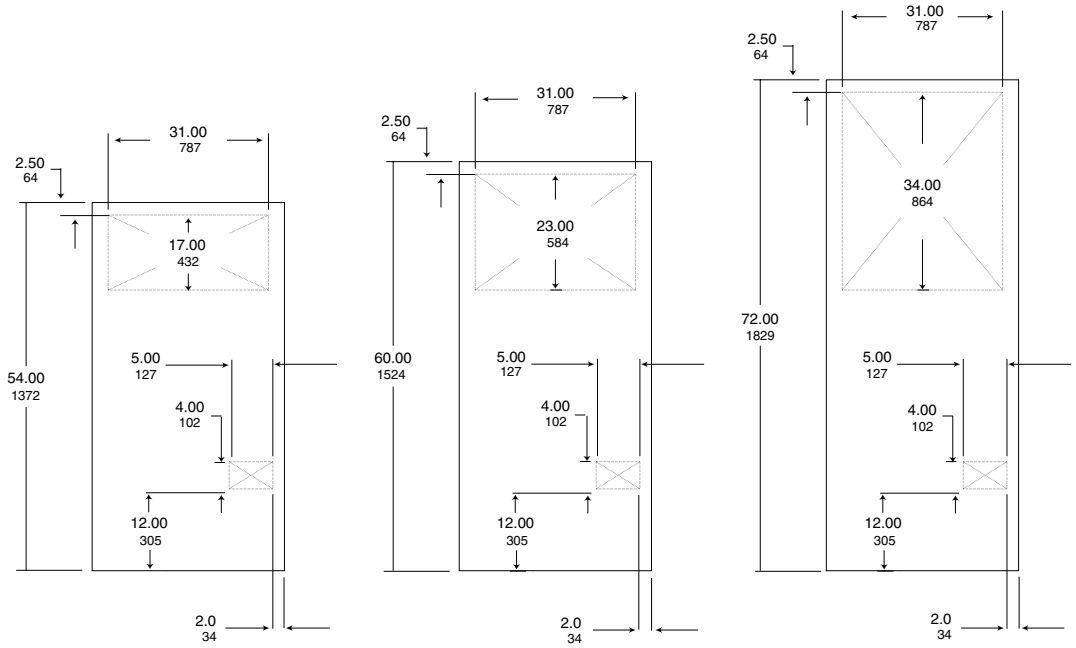
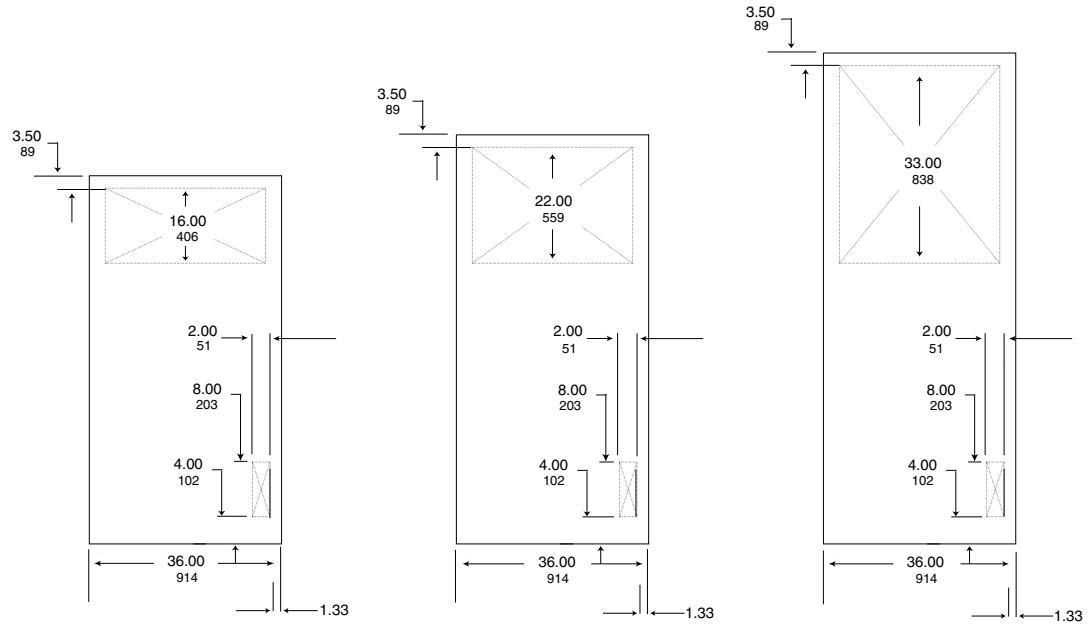
Figure 50: Top and Bottom Conduit Entrance Dimensions (36-inch wide)– Not for Construction (consult factory drawings)



Top Conduit Entrance–Auxiliary Section (36-inch wide)



Bottom Conduit Entrance–Auxiliary Section (36-inch wide)

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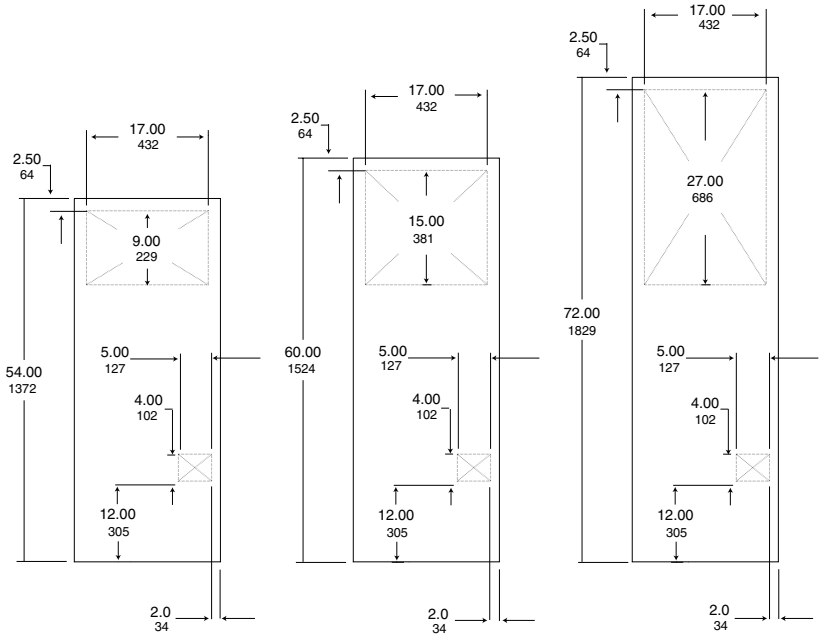
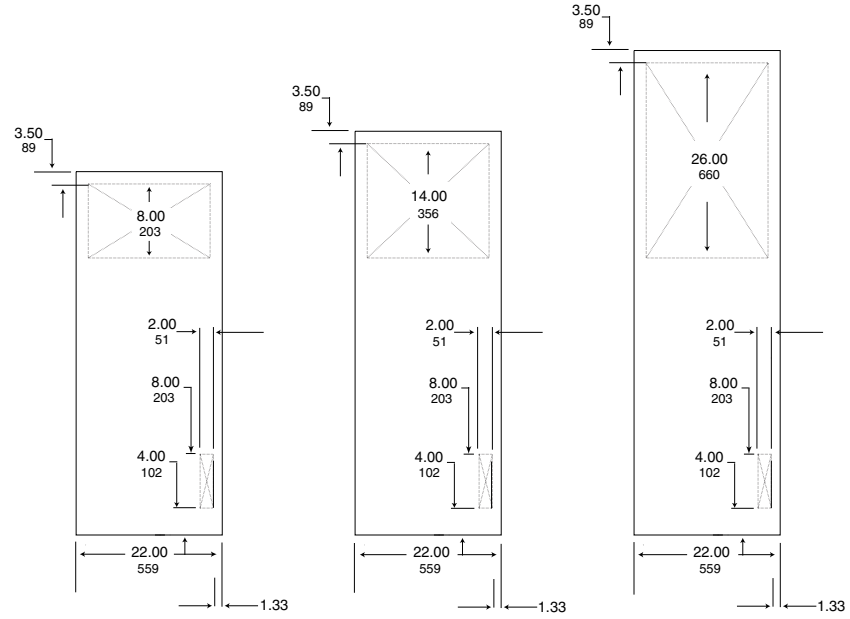
Figure 51: Top and Bottom Conduit Entrance Dimensions (22-inch wide Main, Tie, and Feeder Sections)– Not for Construction (consult factory drawings)



Top Conduit Entrance–Main, Tie, and Feeder Sections (22-inch wide)

NOTE: Top conduit entrance area is reduced when close-coupled with a transformer.



Bottom Conduit Entrance–Main, Tie, and Feeder Sections (22-inch wide)

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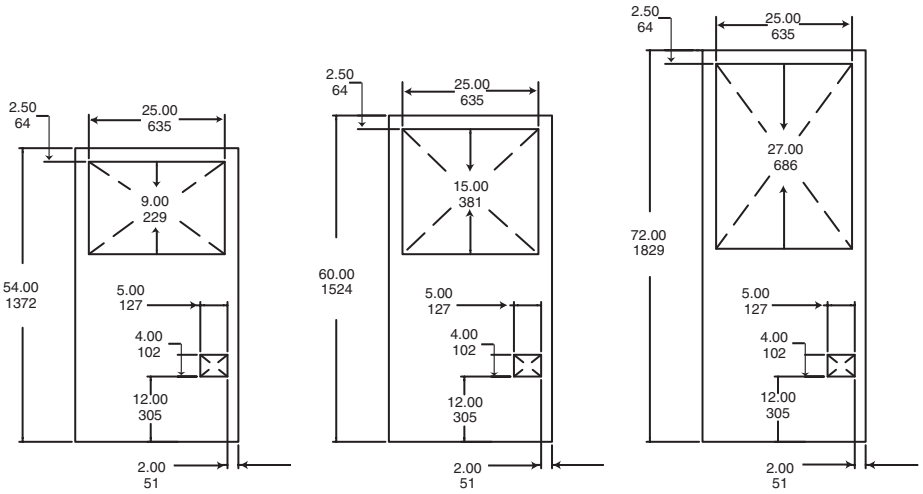
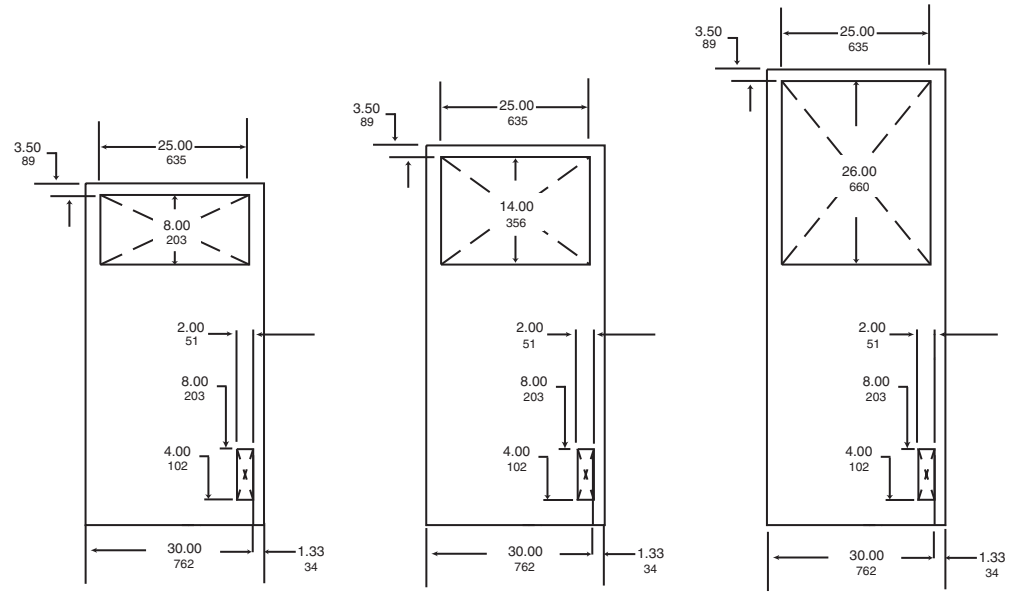
Figure 52: Top and Bottom Conduit Entrance Dimensions (30-inch wide Main, Tie, and Feeder Sections)– Not for Construction (consult factory drawings)



Top Conduit Entrance–Main, Tie, and Feeder Sections (30-inch wide)

NOTE: Top conduit entrance area is reduced when close-coupled with a transformer.



Bottom Conduit Entrance–Main, Tie, and Feeder Sections (30-inch wide)

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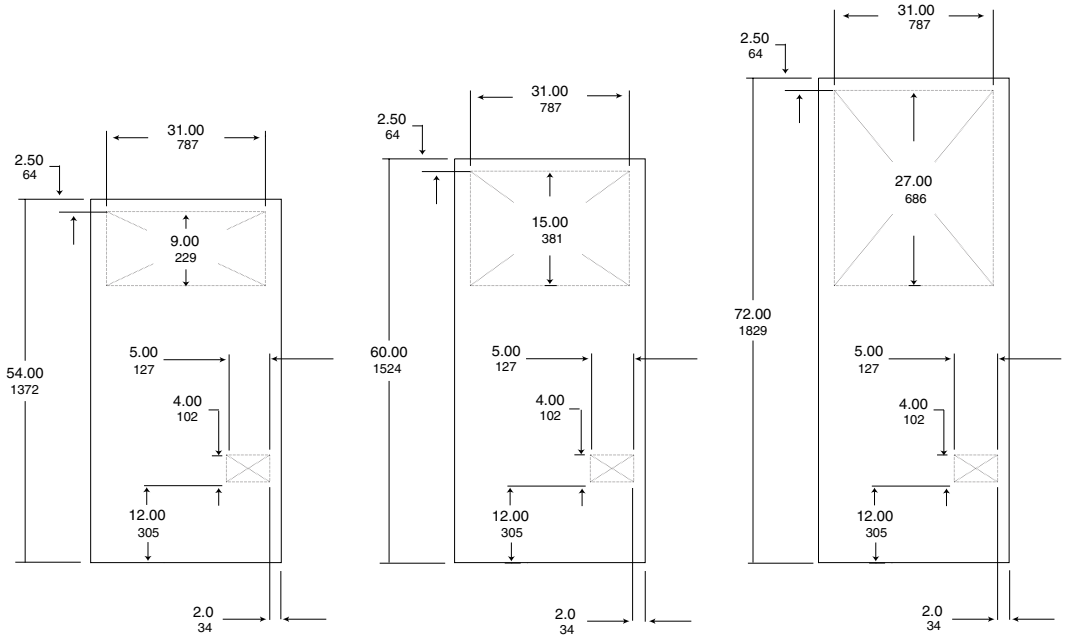
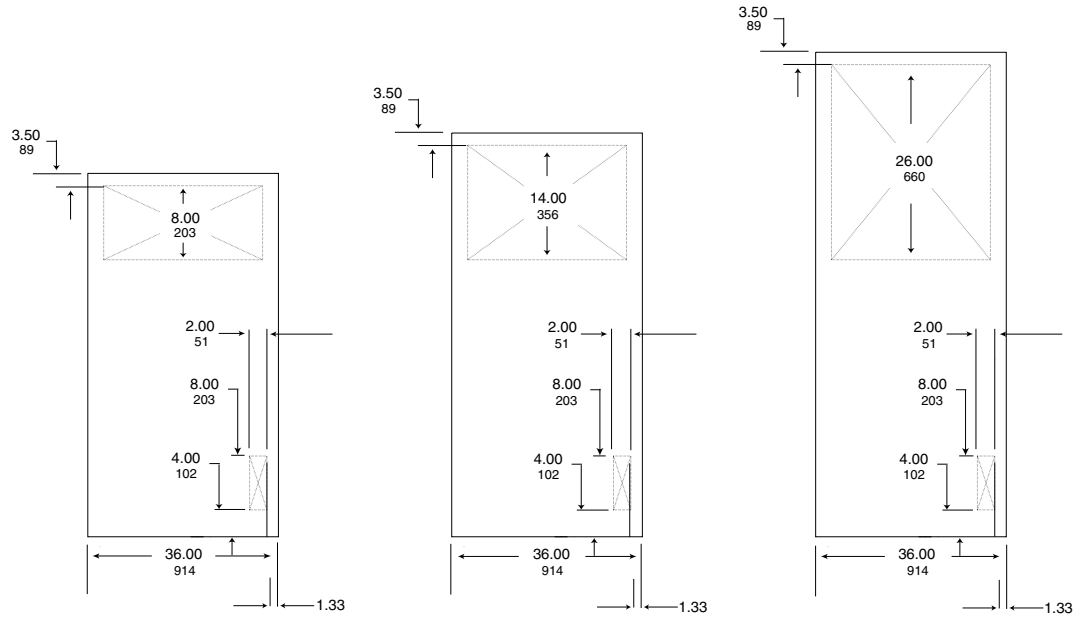
Figure 53: Top and Bottom Conduit Entrance Dimensions (36-inch wide Main, Tie, and Feeder Sections)– Not for Construction (consult factory drawings)



Top Conduit Entrance–Main, Tie, and Feeder Sections (36-inch wide)

NOTE: Top conduit entrance area is reduced when close-coupled with a transformer.



Bottom Conduit Entrance–Main, Tie, and Feeder Sections (36-inch wide)

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Figure 54: NEMA 3R Walk-in Low Voltage Switchboard/Switchgear Top Conduit Entrance Dimensions–Not for Construction (consult factory drawings)

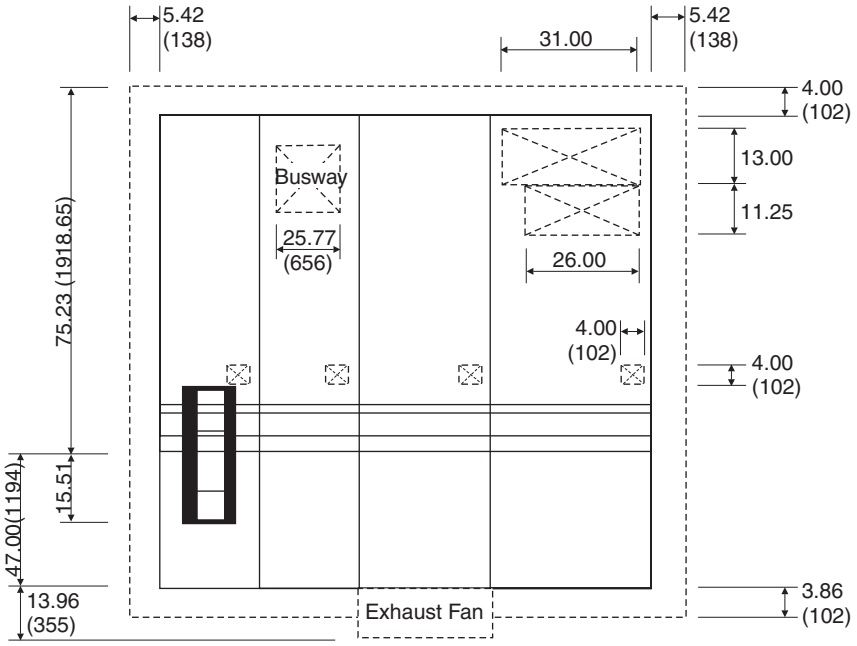

Figure 55: NEMA 3R Walk-in Low Voltage Switchboard/Switchgear Bottom Conduit Entrance Dimensions–Not for Construction (consult factory drawings)

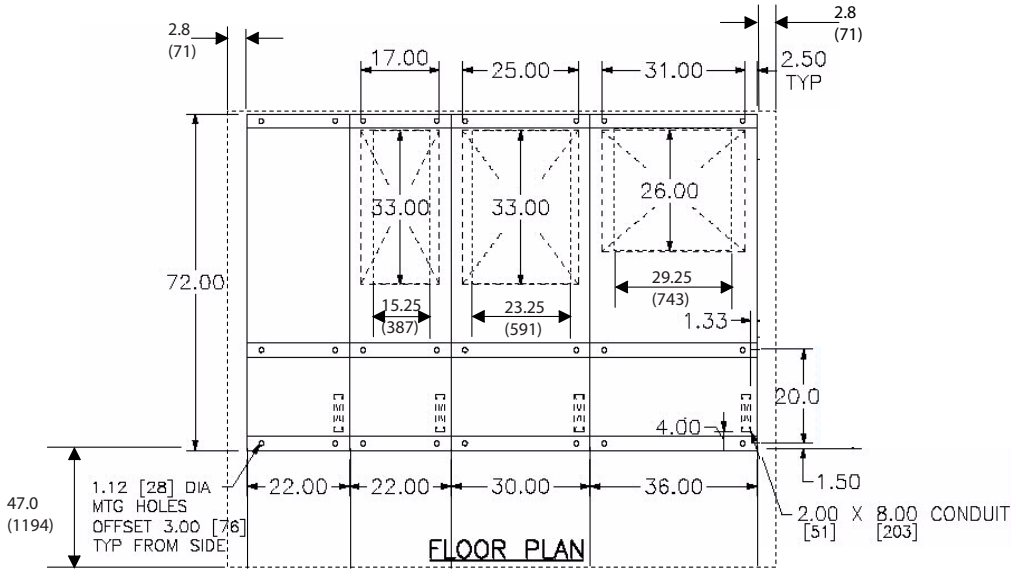

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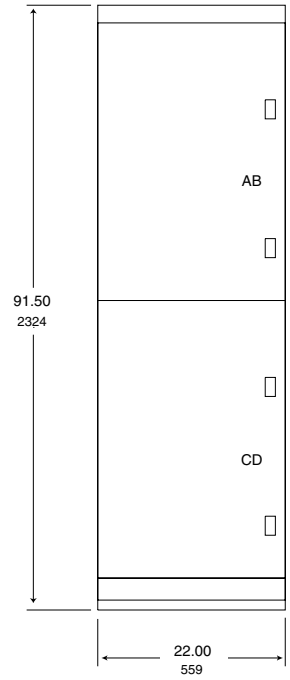
Figure 56: Front Elevation Dimensions–Not for Construction (consult factory drawings)



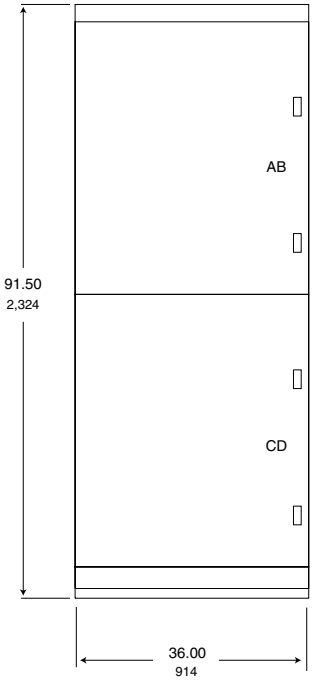
Typical Auxiliary Section–A
(22-inch wide)

Table 11: Typical Auxiliary–A (22-inch wide)

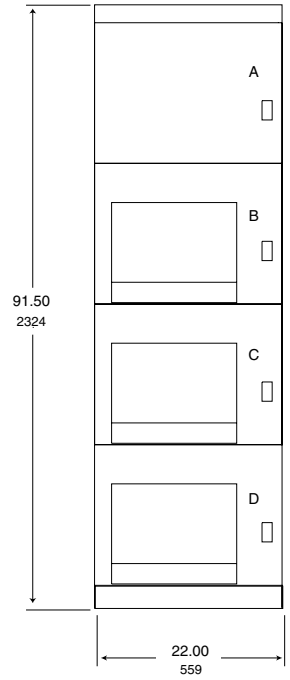
Location	Description
AB	Blank or instrument
CD	Blank or instrument

Table 12: Typical Auxiliary–B (36-inch wide)

Location	Description
AB	Blank or instrument
CD	Blank or instrument



Typical Auxiliary Section–B
(36-inch wide)



Typical Main and Tie Circuit Breakers–A
(22-inch wide)

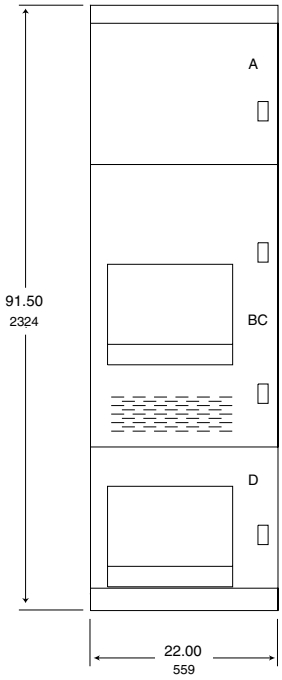
Table 11: Typical Main and Tie–A (22-inch wide)

Location	Description	Frame Size	Frame SCCR
A	Blank or instrument	–	–
B	Main or tie	800 A–2000 A	N1–H2, L1F, NT
C	Feeder	800 A–2000 A	N1–H2, L1F, NT
D	Feeder	800 A–2000 A	N1–H2, L1F, NT

Table 12: Typical Main and Tie–B (22-inch wide)

Location	Description	Frame Size	Frame SCCR
A	Blank or instrument	–	–
BC	Main or tie	3200 A	H1–H2
D	Feeder	800 A–2000 A	N1–H2, L1F, NT

NOTE: Any main, tie, or feeder compartment positions may be used as a blank, or instrument compartment. Not convertible for future circuit breaker use. Height including secondary wiring trough compartment is 93.7 inches (2380 mm).



Typical Main and Tie Circuit Breakers–B
(22-inch wide)

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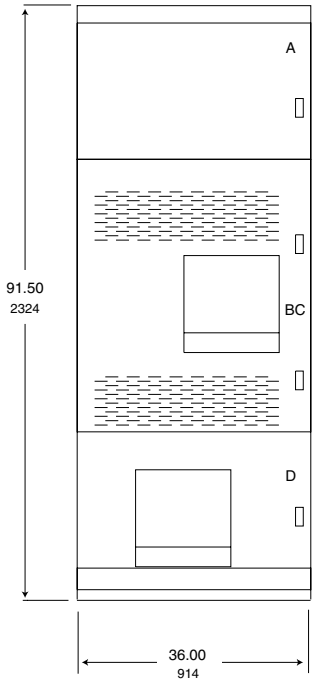
Figure 57: Front Elevation Dimensions–Not for Construction (consult factory drawings)



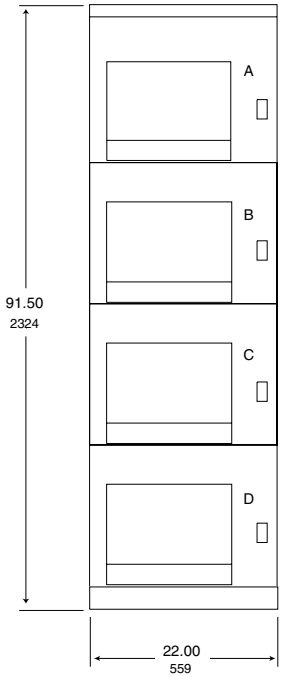
Typical Main and Tie Circuit Breakers–C (36-inch wide)

Table 13: Typical Main and Tie–C (36-inch wide)

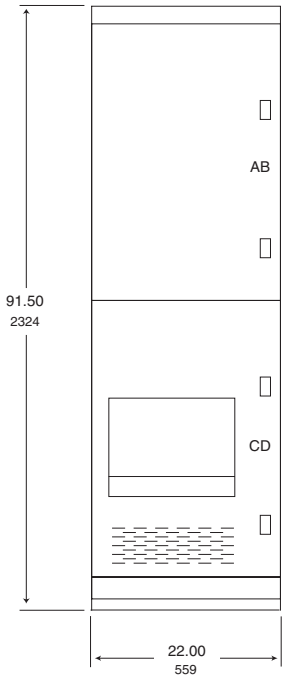
Location	Description	Frame Size	Frame SCCR
A	Blank or instrument	–	–
BC	Main or tie	4000 A–5000 A	H2
D	Feeder	800 A–2000 A	N1–H2

Table 14: Typical Feeder–A (22-inch wide)

Location	Description	Frame Size	Frame SCCR
A	Feeder	800 A–2000 A	N1–H2, L1F, NT
B	Feeder	800 A–2000 A	N1–H2, L1F, NT
C	Feeder	800 A–2000 A	N1–H2, L1F, NT
D	Feeder	800 A–2000 A	N1–H2, L1F, NT



Typical Feeder Circuit Breakers–A (22-inch wide)



Typical Feeder Circuit Breakers–B (22-inch wide)

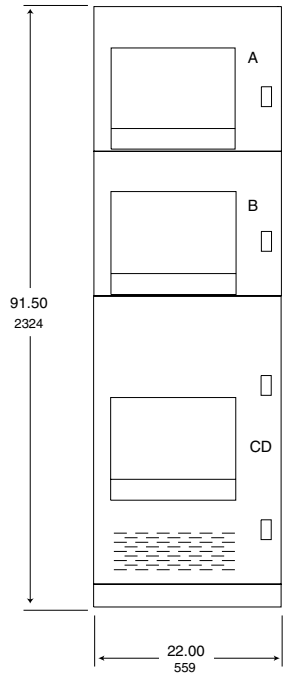
Table 15: Typical Feeder–B (22-inch wide)

Location	Description	Frame Size	Frame SCCR
AB	blank or instrument		
CD	Feeder	3200 A	H1–H2

Table 16: Typical Feeder–C (22-inch wide)

Location	Description	Frame Size	Frame SCCR
A	Feeder	800 A–2000 A	N1–H2, L1F, NT
B	Feeder	800 A–2000 A	N1–H2, L1F, NT
CD	Feeder	3200 A	H1–H2

NOTE: Any main, tie, or feeder compartment positions may be used as a blank, or instrument compartment. Not convertible for future circuit breaker use. Height including secondary wiring trough compartment is 93.7 inches (2380 mm).



Typical Feeder Circuit Breakers–C (22-inch wide)

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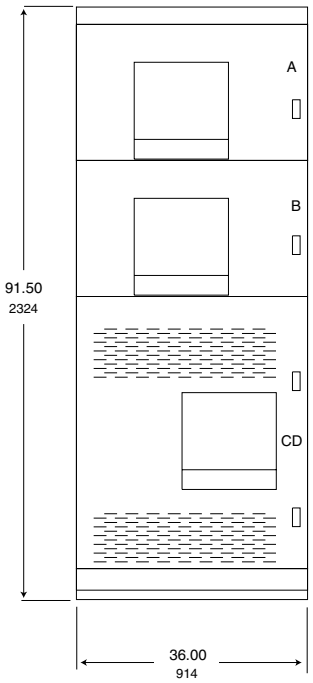
Figure 58: Front Elevation Dimensions–Not for Construction (consult factory drawings)



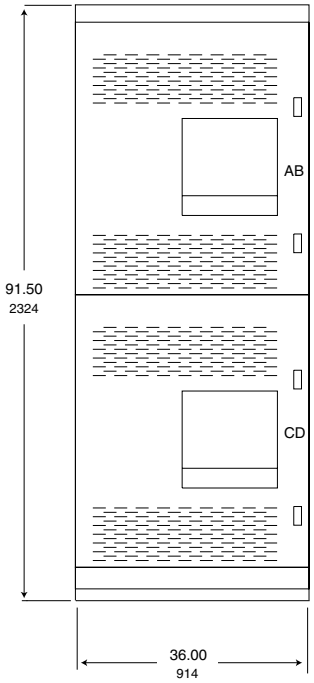
Typical Feeder Circuit Breakers–D (36-inch wide)

Table 17: Typical Feeder–D (36-inch wide)

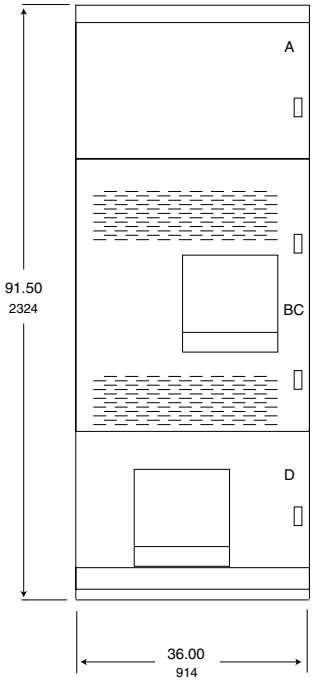
Location	Description	Frame Size	Frame SCCR
A	Feeder	800 A–2000 A	N1–H2, L1F
B	Feeder	800 A–2000 A	N1–H2, L1F
CD	Feeder	4000 A–5000 A	H2

Table 18: Typical Feeder–E (36-inch wide)

Location	Description	Frame Size	Frame SCCR
AB	Feeder	4000 A–5000 A	H2
CD	Feeder	4000 A–5000 A	H2



Typical Feeder Circuit Breakers–E (36-inch wide)



Typical L1 Main and Tie Circuit Breakers–A (36-inch wide)

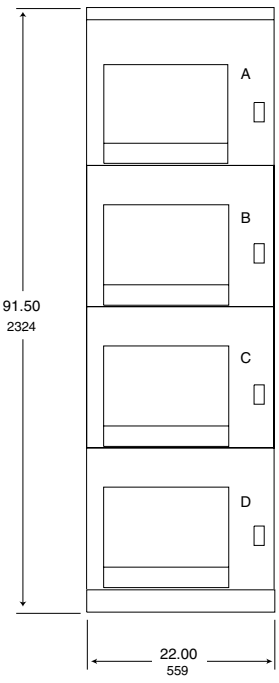
Table 19: Typical L1 Main and Tie–A (200 kA @ 480 V) (36-inch wide)

Location	Description	Frame Size	Frame SCCR
A	Blank or instrument	–	–
BC	Main or tie	2000 A–5000 A	L1
D	Feeder	2000 A	L1, L1F

Table 20: Typical L1 Feeder–A (200 kA @ 480 V) (22-inch wide)

Location	Description	Frame Size	Frame SCCR
A	Feeder	800 A–2000 A	L1, L1F
B	Feeder	800 A–2000 A	L1, L1F
C	Feeder	800 A–2000 A	L1, L1F
D	Feeder	800 A–2000 A	L1, L1F

NOTE: Any main, tie, or feeder compartment positions may be used as a blank, or instrument compartment. Not convertible for future circuit breaker use.Height including secondary wiring trough compartment is 93.7 inches (2380 mm).



Typical L1 Feeder Circuit Breakers–A (22-inch wide)

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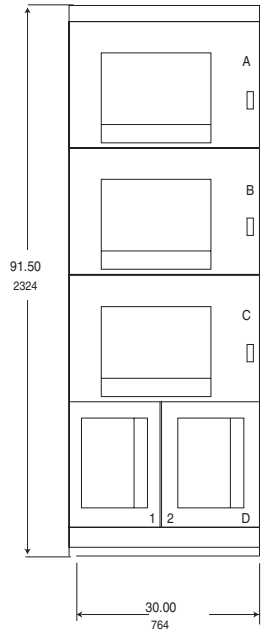
Figure 59: Front Elevation Dimensions–Not for Construction (consult factory drawings)



Typical Feeder Circuit Breakers
(30-inch wide)

Table 19: Typical Feeder–F (30-inch wide)

Location	Description	Frame Size	Frame SCCR
A	Feeder	800 A–2000 A	N1–H2, L1F
A1/A2	Feeder	800 A NT	N1
B	Feeder	800 A–2000 A	N1–H2, L1F
B1/B2	Feeder	800 A NT	N1
C	Feeder	800 A–2000 A	N1–H2, L1F
C1/C2	Feeder	800 A NT	N1
D	Feeder	800 A–2000 A	N1–H2, L1F
D1/D2	Feeder	800 A NT	N1

NOTE: Dimensions–Not for Construction (consult factory drawings)

Figure 60: Front View, NEMA 3R Walk-in Low Voltage Switchboard/Switchgear

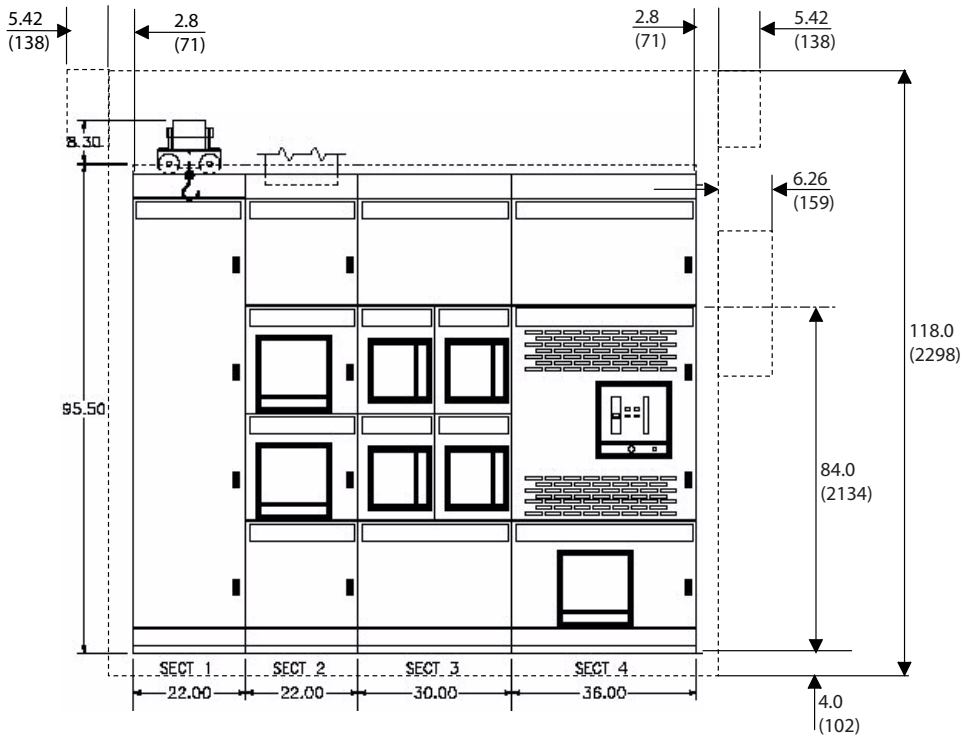


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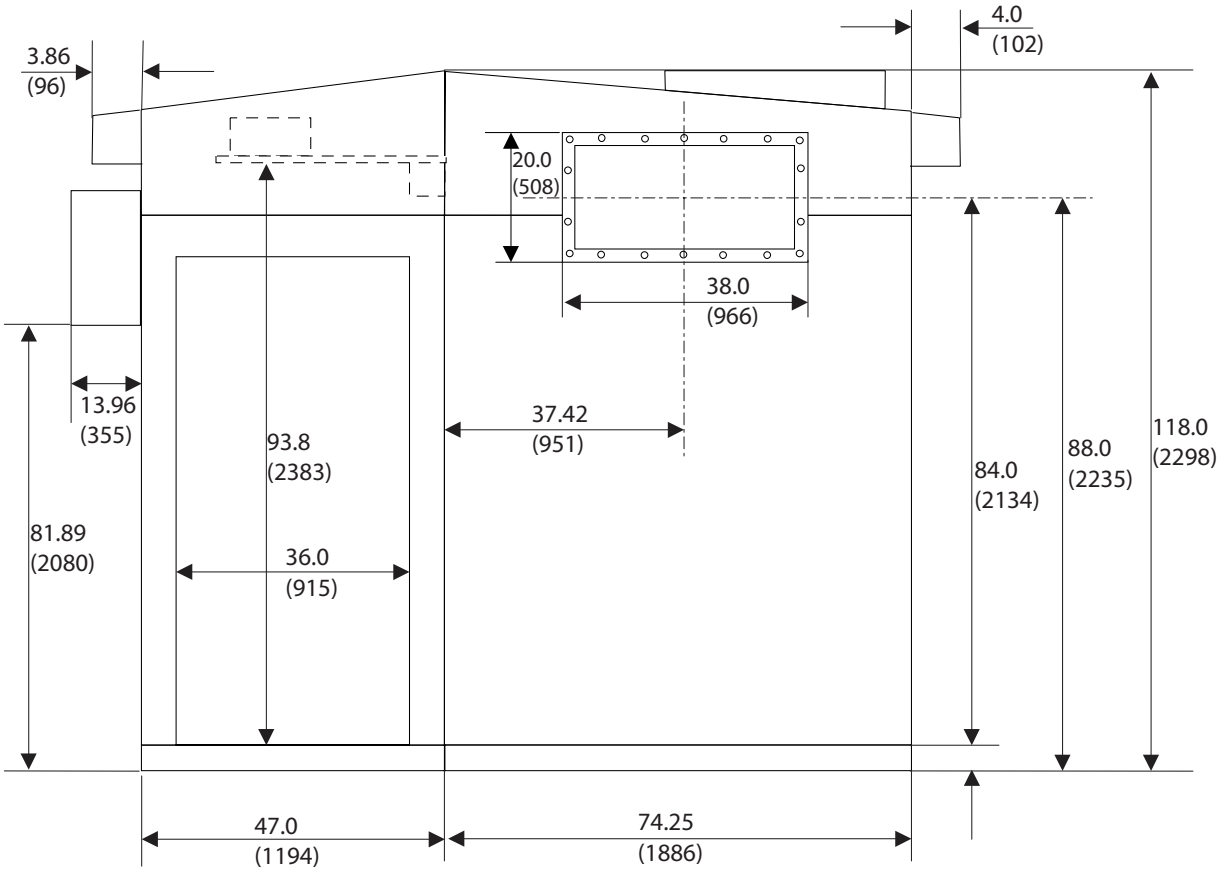
Figure 61: Right Side View, NEMA 3R Walk-in Low Voltage Switchboard/Switchgear



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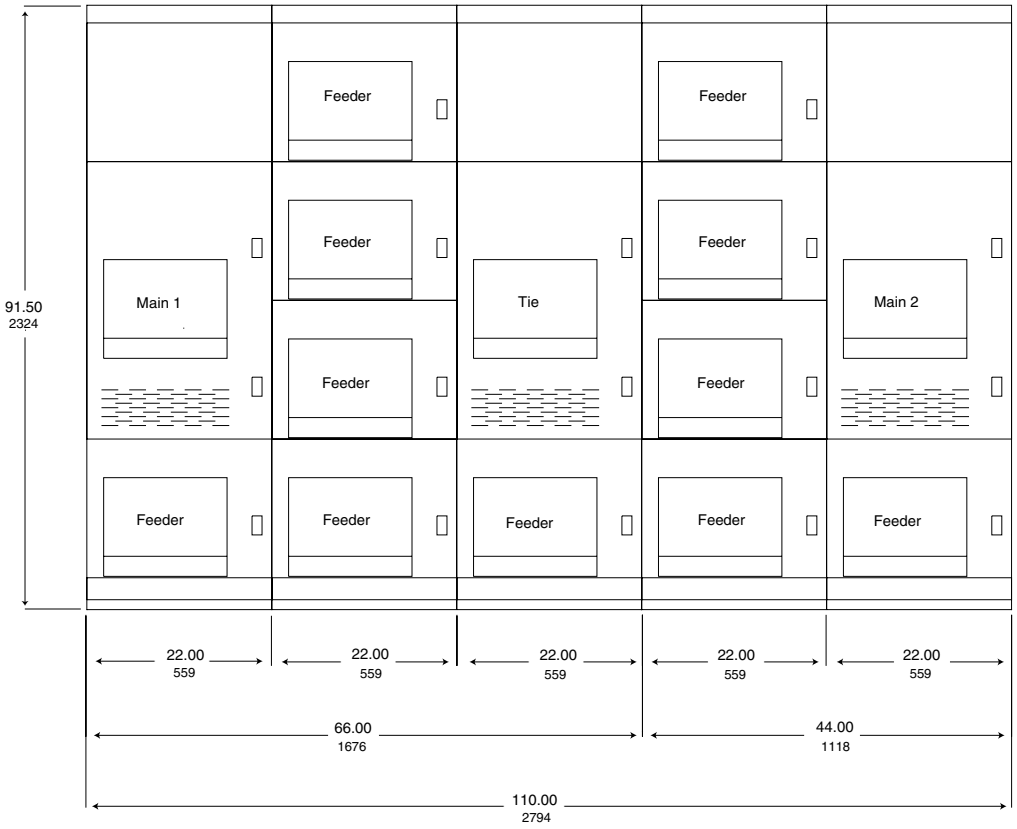
SYSTEM DESIGN

Figure 62: Front Elevation Dimensions–Not for Construction (consult factory drawings)



Typical 5 Bay Representation (22-inch wide) with 3200 A Main-Tie-Main, Double-ended Lineup

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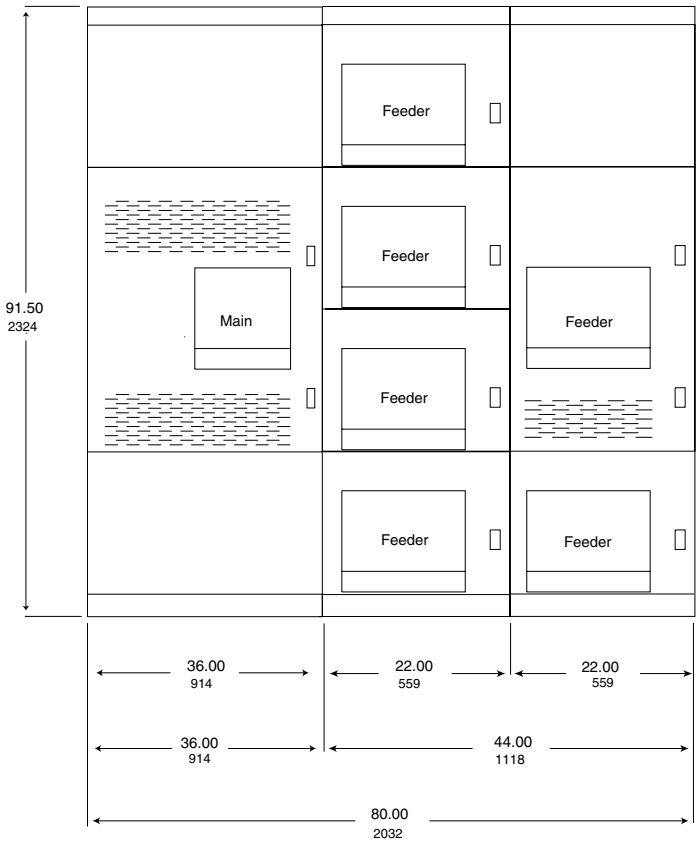
Figure 63: Front Elevation Dimensions–Not for Construction (consult factory drawings)



Typical 3 Bay Representation (36-inch and 22-inch wide)

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WEIGHTS

Refer to the shipping documents for the correct weights and dimensions. The weights given here are approximate values. Consult shipping documents for actual weights.

Table 20: Switchgear 4 High without Circuit Breakers

Bus Rating	22 Wide		36 Wide	
	lbs	Kg	lbs	Kg
1600 A–2000 A	1200	545	1300	591
3200 A	1400	636	1500	682
40000 A–5000 A	1700	773	1800	818

Table 21: Masterpact NW Circuit Breaker Weights

Amperes	Lbs.	Kg.
800	110	50
1600	110	50
2000	110	50
3200	110	50
2000 ①	230	105
3200 ①	230	105
4000 ①	230	105
5000 ①	230	105
①6 Pole (double-wide)		

Table 22: Masterpact NT Circuit Breaker Weights

Amperes	Lbs	Kg
800	40	18

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SECTION 6 : SUGGESTED SPECIFICATIONS

SECTION CONTENTS

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"Standards" 92
"Ratings" 92
"Products" 93
"Manufacturers" 93
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"Circuit Breaker Compartment" 93
"Bus Compartment" 94
"Cable Compartment" 95
"Circuit Breakers and Trip Units" 95
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GENERAL

This specification and associated drawings describe Power-Zone 4 switchgear constructed to ANSI C37.20.1 industry standards. The main components of the switchgear are Masterpact® NW and NT circuit breakers.

NOTE: Square D Type Masterpact circuit breakers are described in "Square D Specifications, Section 16410-5–Low Voltage Power Circuit Breakers".

Standards

Power-Zone 4 switchgear equipment shall be designed, tested, and manufactured according to the following standards.

Standard	Description
ANSI C37.20.1	Metal-enclosed low voltage circuit breaker switchgear
ANSI C.37.51	Testing of metal-enclosed low voltage ac circuit breaker switchgear
NEMA SG-5	Power switchgear assemblies
CAN/CSA C22.2 No. 31-M89	Switchgear assemblies
UBC and CBC	Zone 4 seismic applications
UL 1558	Switchgear assemblies

Main and feeder Masterpact NW and NT circuit breakers used in Power-Zone 4 switchgear shall be designed, tested, and manufactured to the following standards.

Standard	Description
ANSI C37.13	Low voltage ac power circuit breakers used in equipment
ANSI C37.16	Preferred rating, related requirement and application recommendations for low voltage power circuit breakers and ac power circuit breakers
ANSI C37.17	Trip devices for ac and general-purpose dc low voltage power circuit breakers
ANSI C37.50	Testing of low voltage ac circuit breakers
NEMA SG-3	Low voltage circuit breakers
UL 1066	Low voltage circuit breakers

Ratings

Power-Zone 4 switchgear available ampacity ratings are outlined below.

System Ampacity
1600
2000
3200
4000
5000

The short-circuit current rating of the system shall be determined by the available fault current at the Power-Zone 4 switchgear. All circuit interruption shall be accomplished by the Masterpact circuit breakers without the aid of limiter fuses. The short-time rating shall also be a function on the desired selectivity of the electrical system. Short-time ratings shall be equal to interrupting ratings for systems delivering up to 85 kA available fault current.

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Available short-circuit current ratings are outlined below.

Short-Circuit Current Rating			Short-Time	Close and Latch
240 V	480 V	600 V		
42 kA	42 kA	42 kA	42 kA	42 kA
65 kA	65 kA	65 kA	65 kA	65 kA
85 kA	85 kA	85 kA	85 kA	50 kA
200 kA	200 kA	130 kA	30 kA (minimum)	22 kA (minimum)

Powerzone 4 switchgear is designed for use on 50 Hz or 60 Hz electrical systems up to 600 Vac and shall be properly braced to the ratings of the Masterpact NW and NT circuit breakers installed within the switchgear.

PRODUCTS

Manufacturers

Power-Zone 4 switchgear shall be manufactured by Schneider Electric company. The Masterpact NW and NT circuit breakers shall be manufactured by Schneider Electric company.

Structure

Structure specifications for the Power-Zone 4 switchgear are outlined below.

General

A. Each steel section of the switchgear shall contain one or more individual circuit breaker compartments or auxiliary instrument compartments, as well as a bus compartment and rear compartment for outgoing cable connections.
B. A rigid removable steel base channel shall be provided at the front and rear of each section.
C. The exterior and interior switchgear finish shall be medium ANSI #49 gray.

Dimensions

A. Section widths shall be 22-inches, 30-inches, or 36-inches wide, depending on the size of the Masterpact NW and NT circuit breakers being installed in the switchgear.
B. The switchgear lineup shall provide adequate wire bending space for main and feeder Masterpact NW and NT circuit breakers using up to 750 kcmil wires.
C. Section depth shall be 54-inches minimum when using 800 A feeders. Additional depth to the lineup shall be for the sole purpose of additional wire bending and conduit space.
D. Adequate conduit space that allows all conductors to exit the section at the same location.

Moving and Handling

A. The switchgear lineup shall be divided into shipping splits not to exceed 88-inches wide and shall be capable of being lifted overhead or by using a forklift.
B. Each shipping split shall have removable lifting straps.
C. Removable base channels shall be provided with prying slots for ease of final positioning at the job site.
D. For Masterpact NW and NT circuit breakers, an overhead lifter or floor crane shall be provided to ease the installation or removal of circuit breakers in excess of 75 pounds.

Circuit Breaker Compartment

Power-Zone 4 switchgear circuit breaker compartments shall contain Masterpact NW and NT circuit breakers with Micrologic trip units.

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Masterpact NW and NT Circuit Breakers

A. Each circuit breaker shall be mounted in its own barriered compartment.
B. Feeder circuit breakers rated 2000 A or less shall be capable of being mounted in the uppermost compartment without de-rating.
C. The front of the circuit breaker shall protrude through the door of the switchgear allowing access to circuit breaker controls, indicators, and the trip unit.
D. The design shall allow for closed door racking in circuit breaker compartments.
E. Circuit breakers of like frames shall be interchangeable, as standard.
F. Prepared circuit breaker compartments shall include the racking mechanism, bussing, and secondary contacts, as necessary.
G. Circuit breaker and prepared circuit breaker compartments shall be “keyed” to avoid insertion of circuit breakers with similar dimensions but insufficient interrupting ratings, or incorrect frame sizes into an inappropriate circuit breaker compartment.
H. Up to eight (8) physically smaller frame circuit breakers (rated 800 A or less) may be mounted in a 30-inch wide section when fault current interrupting ratings permit. When these smaller sized circuit breakers are used, all requirements listed above shall still be met.

Secondary Connections

A. All customer secondary control and communications connections shall be made from the front of the switchgear lineup.
B. A dedicated wiring channel accessible from the front of the switchgear shall allow easy access to all control or communications terminations.
C. Control connections shall be either cage clamp or optional ring tongue terminals. All control wire shall be #14 gauge SIS.
D. Dedicated conduit entry for control wires shall be provided at the top and bottom of each section, capable of landing up to four 3/4-inch conduits and accessible from the front of the switchgear.
E. All interconnections between switchgear sections at shipping splits shall use locking, pull-apart type terminal blocks.
F. All secondary and communication wiring shall be securely fastened to the switchgear with minimal use of adhesive backed wire anchors. Adhesive backed anchors shall be allowed on doors to aid in wire routing.

Instrumentation

A. Where additional space is required for instrumentation, such as CPTs and metering, a barriered auxiliary instrumentation compartment shall be used in the switchgear.
B. The auxiliary instrumentation compartment shall not inhibit the routing of control or communication wires.

Bus Compartment

A. All vertical and cross bus shall be rated for the full ampacity of the switchgear lineup.
B. All bus joints shall consist of grade 5 hardware and conical washers to withstand mechanical forces exerted during short circuits. All bus joints shall consist of a minimum of 2 bolts.
C. Bus shall be plated along its entire length.
D. Bus shall be braced to withstand the instantaneous interrupting rating of the main breaker(s) or 65 kA minimum.
E. Optional barriers shall be available to separate the bus and cable compartments.

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Cable Compartment

A. All incoming or outgoing power conductors shall be routed through the rear cable compartment.

B. Feeder circuit breakers shall have adequate wire bending space, regardless of the circuit breaker interrupting rating.

The table below lists the section depth needed to meet wire bending requirements.

Feeder Circuit Breaker	Section Depth (inches)
800 A (max.)	54
4000 A (max.)	60
4000 A (max.)	72 (optional)
4000 A (max.)	80 (optional)

C. The conduit area for each section shall be a minimum of 17-inches wide and provide adequate depth for all section conduits.

D. Select depth based on the table requirements listed below. The dimensions in the table indicate approximate conduit area for cable fed mains and feeders. All dimensions are in inches.

Section Width (inches)	Section Depth			
	54-inches	60-inches	72-inches	80-inches
22	17 W x 8 D	17 W x 14 D	17 W x 26 D	17 W x 34 D
30	25 W x 8 D	25 W x 14 D	25 W x 26 D	25 W x 34 D
36	31 W x 8 D	31 W x 14 D	31 W x 26 D	31 W x 34 D

E. Barriers to separate the cable compartment from the adjacent cable compartment shall be available for the switchgear assembly.

Circuit Breakers and Trip Units

Masterpact NW and NT Circuit Breakers

A. Circuit breakers shall be Masterpact® NW and NT circuit breakers. Listed to UL 1066.

B. Circuit breakers shall be suitable for the required instantaneous rating without the use of external current limiting fuses.

C. All circuit breakers shall have field interchangeable electrical accessories, including shunt trip, auxiliary contacts, electrical operating mechanism, shunt close, and trip unit.

D. All secondary connections shall be made directly to the front of the circuit breaker cradle.

E. Each circuit breaker shall have built-in contact temperature sensors and contact wear indicators.

Micrologic (Basic, Type A, Type P, and Type H) Trip Units

A. All trip units shall be removable to allow for field upgrades.

B. Trip units shall incorporate “true RMS sensing,” and have LED long-time pickup indications.

C. The table on page 95 lists the standard and optional trip unit features for Micrologic Type A (ammeter), Type P (Power Metering), and Type H (Harmonics) trip units for use in Power-Zone 4 switchgear.

Select the appropriate trip unit(s) for the system performance desired.

Functions	Basic	Type A	Type P	Type H
True RMS sensing	X	X	X	X
LI trip configuration	X	X	X	X
LSI	O	O	X	X

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Functions	Basic	Type A	Type P	Type H
LSIG/ground fault trip	–	O	X	X
Ground fault alarm (no trip)	–	–	X	X
Ground fault trip and programming alarm	–	–	O	O
Adjustable rating plugs	X	X	X	X
LED – long–time pickup	X	X	X	X
LED – trip indication	–	X	X	X
Digital ammeter	–	X	X	X
Phase loading bar graph	–	X	X	X
Zone selective interlocking	–	X	X	X
Communications	–	O	X	X
LCD dot matrix display	–	–	X	X
Advanced user interface	–	–	X	X
Protective relay functions	–	–	X	X
Thermal imaging	–	–	X	X
Contact wear indication	–	–	X	X
Temperature indication	–	–	X	X
Incremental fine tuning of settings	–	–	X	X
Selective long-time delay bands	–	–	X	X
Power measurement	–	–	X	X
Waveform capture	–	–	–	X
Data logging	–	–	–	X

Table Values:

– Not Applicable

X Standard Feature

O Optional Feature

Metering and Instrumentation

Metering and communication requirements for Power-Zone 4 switchgear are listed below.

Main Metering

A. Metering requirements that exceed the capabilities of the circuit breaker trip units shall use the optional Powerlogic® Power Monitoring System.
B. Three metering current transformers shall be appropriately sized for use on the incoming section.
C. Separate low voltage HMI and circuit monitor display shall be mounted near the incoming section.
D. Optional input/output (I/O) and the Ethernet communications card shall be provided as necessary.

Communications

A. Internal communications in the switchgear shall be Modbus® protocol.
B. Where necessary, an Ethernet gateway shall be located near the switchgear assembly and be capable of accepting inputs from the Micrologic® trip unit(s), Powerlogic circuit monitor(s), and Modicon PLCs.

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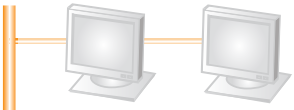
Gain energy insight and control with PowerLogic™

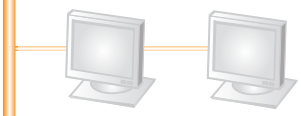
PowerLogic ION7300 series

power and energy meter

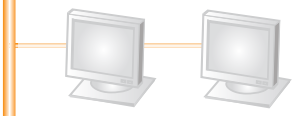
Schneider Electric



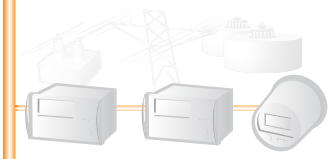
Financial management including accounting and billing



Facility and energy management

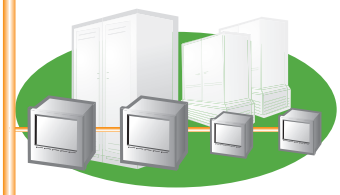


Operations management including engineering, planning and maintenance

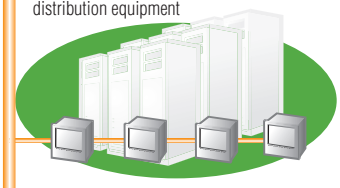


Power generation, transmission and distribution

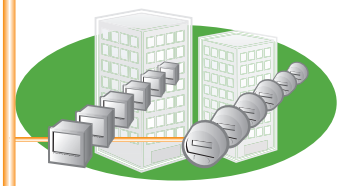
Service entrances and onsite generation



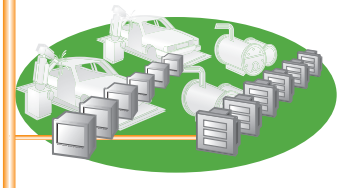
Power mitigation and main power distribution equipment



PDUs and data servers



Tenants, departments or subcontractors



Processes, lines, machines or equipment

Integrated network comprising corporate intranet, Internet, serial, dialup or wireless connections

Features

Measurements

Bidirectional, absolute, and net energy measurements. Rolling block, predicted, and thermal demand. Individual and total harmonic distortion up to the 31st. Advanced logic and mathematical functions.

Internet-enabled communications

Two RS-485 ports, infrared data port standard. Optional built-in modem with ModemGate allows modem access for 31 other devices. Optional Ethernet port with EtherGate allows direct Ethernet-to-RS-485 data transfer to 31 other devices. Modbus RTU, Modbus TCP, DNP 3.0, and PROFIBUS DP. Call-back feature offers fast alarm response. WebMeter and MeterM@il® allow distribution of metered data and alarms over the Internet.

Interoperability

Communicate via multiple protocols to add to existing Modbus, DNP or ION Enterprise networks. Logs and real-time values are available via Modbus. These meters are supported by UTS MV-90® via serial and Ethernet.

On-board data logging

Scheduled or event-driven logging of up to 96 parameters. Sequence-of-events and min/max logging.

Setpoints for control and alarms

Use logical operators and setpoints to configure alarms, define basic control algorithms, and implement back-up protection. Setpoints can trigger data logging, digital outputs, pulse outputs, clearing and reset functions, call-back (ION7350).

Logic and math

Sophisticated logic and mathematical functions to perform on-board calculations on any measured value (ION7330, ION7350).

Inputs and outputs

Four digital inputs for status/counter functions. Four digital outputs for control/pulse functions. Optional analogue inputs and outputs.

Front panel display

Easy to read backlit LCD with adjustable contrast, supporting eight customisable data displays (scrolled automatically or manually) and basic setup.

PowerLogic ION7300 with remote modular display

Typical uses within a PowerLogic power and energy management system

PowerLogic ION7300 series

Schneider Electric PowerLogic ION7300 series meters offer unmatched value, functionality, and ease of use. Used in enterprise energy management applications such as feeder monitoring and sub-metering, PowerLogic ION7300 series meters interface with ION Enterprise software or other power management or automation systems to provide users with real-time information for monitoring and analysis.

The meter is available in three models, with incremental features sets and a variety of options. PowerLogic ION7300 meters are an ideal replacement for analogue meters, while also providing a multitude of power and energy measurements, analog and digital I/O, communication ports and industry-standard protocols. The ION7330 meter adds on-board data storage, emails of logged data, and an optional modem. The ION7350 meter is further augmented by more sophisticated power quality analysis, alarms and a call-back-on-alarm feature. Refer to the detailed descriptions within for a complete list of feature availability.

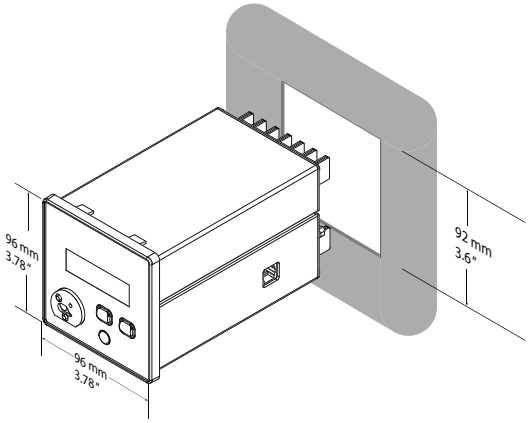
Applications

For infrastructure, industrials and buildings

- Energy efficiency and cost
  - Sub-bill tenants for energy costs
  - Allocate energy costs to departments or processes
  - Reduce peak demand surcharges
  - Reduce power factor penalties
- Power availability and reliability
  - Verify the reliable operation of equipment
  - Improve response to power quality-related problems
  - Leverage existing infrastructure capacity and avoid over-building
  - Support proactive maintenance to prolong asset life

For electric utilities

- Power availability and reliability
- Improve T&D network reliability
- Enhance substation automation
- Maximise the use of existing infrastructure
- Analyse and isolate the source of power quality problems



Installation

Standard PowerLogic ION7300 series meters with integrated display are designed to fit into DIN standard 92 X 92 mm (3.62 x 3.62 in.) cutout. Simply slide the mounting bars into the grooves on either side of the unit. The TRAN option provides a base unit without display that can be mounted either flush against any flat surface in whichever orientation is most convenient; attached to any standard DIN rail (requires optional DIN rail mount); or installed in a cutout (as the standard model). The remote modular display (RMD) can be mounted as the standard unit. A 1.8 m (6 ft.) cable is supplied.

4-wire Wye, Delta, 3-wire Wye, Direct Delta and single phase systems. 3 voltage and 3 current inputs. No PTs required on voltage inputs for Wye systems up to 347/600 V ac and Delta systems up to 600 V ac. All inputs pass ANSI/IEEE C37.90.1-1989 surge withstand and fast transient tests.

Input(s)	Specifications
Voltage inputs	
Inputs	U1, U2, U3, Uref
Rated inputs1	50 to 347 L-N (87 to 600 L-L) V ac rms (3-phase systems) 50 to 300 L-N (100 to 600 L-L) V ac rms (single-phase systems)
Overload	1500 V ac rms continuous
Input impedance	> 2 M Ωper phase (phase-vref)
Current inputs	
Inputs	I1, I2, I3
Rated inputs	10 A rms (+ 20% maximum, 300 V rms to ground)
Overload	20 A continuous
Dielectric withstand	500 A for one second (non-recurring)
Burden	0.0625 VA @ 10 Amps
Control power	
Operating range	Standard model: 95 to 240 V ac ±10% (47 - 440 Hz); DC: 120 to 310 V dc ±10% P24 option: 20 to 60 V dc ±10%
Current transformers	
Compatibility	5 A nominal, 10 A full-scale secondaries.
Primary CT rating	Equal to current rating of the power feed protection device.2
Secondary CT burden capacity	> 3 VA

1 Accuracy may be affected if the voltage on V1 falls below 50.
2 If the peak anticipated load is considerably less than the rated system capacity, you can improve accuracy and resolution by selecting a lower rated CT.

PowerLogic ION7350

Front panel

Easy to read backlit LCD with adjustable contrast. LCD supports local data display and basic setup. Remote display option to 1.8 m (6 ft) from base unit. Eight data display screens (kWh net, kWh swd / mx, Volts, Amps, Power, Frequency, V-THD, I-THD) can be customised through the communications port to show chosen parameters, and scrolled manually or automatically. The front panel can display up to nine digits of resolution for numeric values. Four display formats are available: 4 parameter, to single-parameter large character displays. Customer-designed parameter labels are programmable via PowerLogic ION Enterprise software.

Example meter display formats.

Power and energy measurements

Fully bi-directional, 4-quadrant, revenue-accurate or revenue-certified energy metering. They can replace discrete energy meters, demand meters and pulse initiators, and perform a wide range of other metering and instrumentation functions.

Supports thermal demand and sliding window (rolling block) demand. Factory-configured to calculate average current demand and kW, kvar and kVA demand. User-configureable time intervals for demand calculations and sensitivity settings.

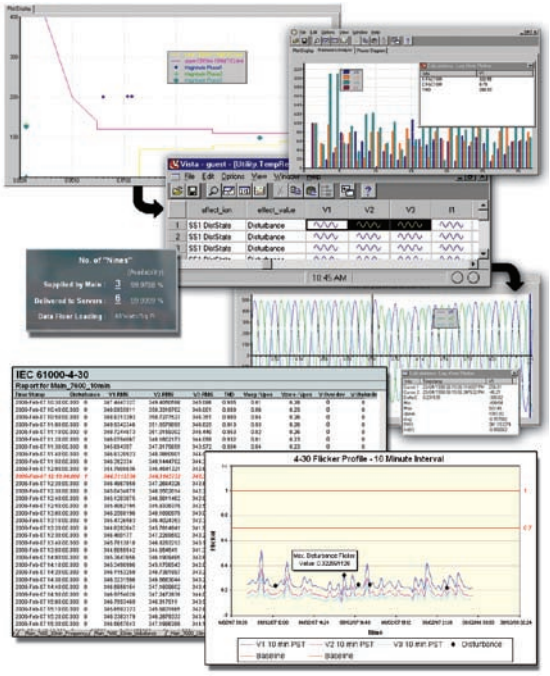
Measurement specifications[1] (at 50.0 Hz and 60.0 Hz at 25° C / 77° F)	Accuracy 1 (%rdg + %fs[2])
Voltage	0.25% + 0.05%
Current	0.25% + 0.05%
Power, real (kW)	0.5% reading
Energy, real (kWh)	0.5% reading[3]
Power, apparent (kVA)	0.5% + 0.1%
Energy, apparent (kVAh)	1.0% reading
Power, reactive (kvar) > 5 % FS	1.5% reading
Energy, reactive (kvarh)	1.5% reading
Power factor (at unity PF)	1.5% reading
Frequency U1,U2,U3 (42-69 Hz): per phase, total	±0.01 Hz

Display resolution meets or exceeds accuracy.

1 50 V ac to 347 V ac + 25 %

2 % full scale voltage and current. Accuracy specifications comply with IEC 60687 Class 0.5 and ANSI 12.20 Class 0.5 at 25°C (77°F)

3 Register bounds 0 to ± 3.3x107 (kW) and 0 to ± 1038 (kWh)



Example from PowerLogic ION Enterprise software showing continuous, wide-area monitoring, data capture and reporting for power quality and reliability conditions.

Power quality

Use meter data to help uncover the sources of harmonics and voltage sags/swells. Analyse problems and avoid repeat interruptions.

- Harmonics (all models): individual harmonics, even, odd, total up to 15th (31st on ION7350). Total harmonic distortion: 1% Full Scale. I4 derivation. 1% reading + 0.2% unbalanced. K Factor: 5.0 % Full Scale.
- Sag/swells (ION7350 only): monitors applicable phase voltages for temporary undervoltages and overvoltages (i.e. CBEMA Type 2 and Type 3 disturbances). Voltage waveforms for sags and swells; report on each disturbance magnitude and duration.
- Sampling rate (all models): Up to 32 samples per cycle (64 on ION7350).
- Waveform (digital fault) recording (ION7350 only): Simultaneous event capture on all channels, up to 48 cycles each. Resolution: 64 samples per cycle; maximum number of cycles for contiguous waveform capture: 6,900 (16 samples/cycle x 48 cycles). depth of 3, the interval is triggered on demand.

.

Example log configurations

Waveform recording settings

Meter	Event	Data	Channel	Samples/ channel	Cycles	Record	Days
7330	500	A	-	-	-	-	29
	500	B	-	-	-	-	118
	500	C	-	-	-	-	96
	500	D	-	-	-	-	383
7350	500	A	6	32	12	3	28
	500	B	6	32	12	3	111
	500	C	6	16	48	3	26
	500	D	6	64	16	3	331

A 16 parameters recorded every 15 minutes
B 16 parameters recorded hourly
C 4 parameters recorded every 15 minutes
D 4 parameters recorded every hour

Data and event logging (ION7330, ION7350)

Ships with a comprehensive data-logging configuration. Data is prioritised and stored onboard in nonvolatile memory to eliminate data gaps in the event of outages or server downtime. Retrieved data is stored in an ODBC-compliant database when using ION Enterprise. Logs various power system data such as energy and demand, or the average power system quantity used over a period of time (Historic Mean Log). Standard memory capacity for both meters is 304 kilobytes. Default logging depth is set for 930 records.

- Historic log: record any combination of measurements at scheduled intervals by setpoints or logic conditions. Configure for up to 30 days of recording capacity at 15 minute intervals. Default depth of 930, interval of 900 seconds (15 minutes).
- Min/Max log: on any parameter, over any time interval (e.g. daily, monthly). Easily record other values coinciding with the new minimum or maximum. Defaults: min and max for all basic power parameters.
- Report Generator log (EgyDmd Log): Default depth and interval.
- Sag/Swell log (ION7350 only): Detect sags, swells on any voltage channel and record instantaneous values and waveforms. Depth of 100; interval triggered on demand.
- Event log: Depth of 50; nterval triggered on demand.

Time of use (TOU)

2-year internal calendar with up to 15 daily tariff profiles. Programmable triggers.Separate energy and demand accumulators.

Event priorities and alarming

Configurable event priorities allow you to define alarm conditions. Sequence-of-events time-stamped to ±10ms accuracy. Time-stamped record of all configuration changes, setpoint and min/max events.

Inputs and outputs

All meter models: four digital outputs, one infrared data port, one configurable LED output. Four digital status inputs standard on ION7330 and ION7350 meters. Optional analogue I/O ports can be used to monitor flow rates, RPM, fluid levels, oil pressures and transformer temperatures. Output real-time power to an RTU or perform equipment control operations.

Type	Input / output	Specifications
Solid state relays	4 Form A digital outputs: D1-D4[1]	Maximum voltage: 30 V dc; maximum current: 80 mA; isolation: optical; continuous or pulse signals
Digital Self-excited (internal 30 V dc supply)	4 inputs (option): S1 - S4	Self-excited (internal 30 VDC supply). Min pulse width: 25 ms. Max. transition rate: 40 transitions per second (20 Hz).
Analogue (option)[1]	4 inputs: AI 1 to AI 4	Accuracy ±0.3% of full-scale; update rate 1 Hz; max. common mode voltage 30 V. 0-20 mA (scalable to 4-20 mA) option: input impedance 25 Ω, maximum source impedance 500 Ω. 0-1 mA option: input impedance 475 Ω, maximum source impedance 10 kΩ.
	4 outputs: A1 to A4	Accuracy ±0.3% of full-scale; channel to channel isolation: none. Max. common mode voltage: 30 V. 0-20 mA (scalable to 4-20 mA) option: max. load drive capability 500 Ω. 0-1 mA option: max. load drive capability 10 kΩ.

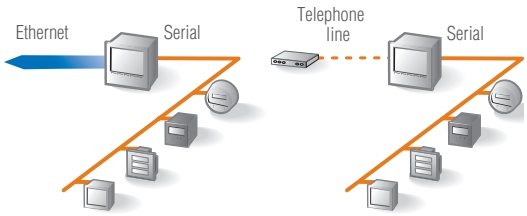
1 Analogue I/O is not available with RMD or Ethernet options.

EtherGate and ModemGate

The meters can provide gateway functionality depending on communication options.

EtherGate: provides access from an Ethernet network using Modbus TCP protocol to devices connected to the meter's serial ports.

ModemGate: provides access from the telephone network to devices connected to the meter's serial ports.



Internet connectivity

XML: to integrate with custom reporting, spreadsheet, database, and other applications.

WebMeter: an on-board web server, provides access to real-time values and PQ data through any web-enabled device and even supports basic meter configuration tasks.

MeterM@il: automatically emails user-configured, high-priority alarm notifications or scheduled system-status update messages to anyone, anywhere within the facility or around the world.

Communications

Multiple communication ports that operate simultaneously allow the meters to be used as part of a power and energy management system and to interface with other automation systems. Upload waveforms, alarms, billing data, and more to software for viewing and analysis.

Port	Specifications
RS-485 ports	ION7300 has a single RS-485 port. ION7330 and ION7350 meters can have two RS-485 ports. Supports DNP 3.0
Infrared data port	Front panel optical port. Compatible with an ANSI Type 2 magnetic optical communications coupler. Data rates up to 19,200 bps.
Ethernet port (optional)	Optional 10Base-T port for direct access to metering information via Ethernet LAN/WAN. EtherGate (data transfer between Ethernet and RS-485).[1]
PROFIBUS port (optional ION7300 only)	PROFIBUS DP standard protocol support via sub-D 9 pin female connector.
Internal modem (ION7330, ION7350)	Data rates from 300 bps to 33,600 bps. RJ-11 connector, ModemGate (data transfer between modem and RS-485).[2] Compatible with power monitoring software that supports Modbus RTU, ION or DNP 3.0. The ION7350 meter is offered with a call-back feature for quick alarm response.

1 The meter COM2 port functions as a dedicated EtherGate port (RS-485 Master) on ION7330 and ION7350 meters with the Ethernet option
2 The meter COM1 port functions as a dedicated ModemGate port (RS-485 Master) on ION7330 and ION7350 meters with the internal modem option

Software integration

PowerLogic ION7330 and ION7350 can communicate via multiple protocols to extend existing Modbus, DNP or ION Enterprise networks. Logs and real-time values are available via Modbus. Meters supported by UTS MV-90® via serial and Ethernet. Integrate within PowerLogic facility-level or enterprise-wide power and energy management systems. Real-time data and data logs stored onboard can be automatically retrieved on a scheduled basis for analysis at the system level. Compatible with PowerLogic ION Enterprise and PowerLogic ION Setup.

Special features

Flash-based firmware allows upgrades via communications without removing the meter from the site. Simply download the latest firmware from www.powerlogic.com.

General specifications

Description	Specifications
Accuracy	IEC 60687 class 0.5S; ANSI C12.16; ANSI class 10, (5 A nominal, 10 A max); OFGEM approved (UK)
Safety/construction	IEC 1010-1; CE marked; UL: Certified to UL 3111; CAN/CSA C22.2 No.1010-1
Electromagnetic compatibility	EN 55014-1:1993; EN 61000-4-4; EN 60687:1993 for immunity to electromagnetic HF fields; EN 60687:1993 for immunity to electrostatic discharges. Analog I/O: each analog I/O pin passes IEC 61000-4-4 (4 kVp-p @ 2.5 kHz for 1 min).
Surge withstand	All inputs pass ANSI/IEEE C37.90-1989 surge withstand and fast transient tests
Environmental conditions	Operation: -20° C to +60° C (-4° F to +140° F) ambient air; Storage: -30° C to +85° C (-22° F to +185° F) Humidity: 5 % to 95 % non-condensing; FCC: Part15, FCC Rules for Class A Digital Device (emissions)

Features and options	ION7300	ION7330	ION7350
Metering			
Power, energy and demand	■	■	■
Power quality			
Dip/swell monitoring			■
Harmonics: individual, even, odd, up to	15th	15th	31st
Sampling rate, maximum samples per cycle	32	32	64
Logging and recording			
Standard memory		300 kB	300 kB
Min/max logging for any parameter	■	■	■
Historical logs, maximum # of channels		32	96
Waveform logs, maximum # of cycles			48
Timestamp resolution in seconds		0.001	0.001
Communications and I/O			
RS-485 ports	1	2	2
Ethernet/infrared optical ports	1/1	1/1	1/1
Internal modem		1	1
PROFIBUS DP port	1		
DNP 3.0 through serial, modem, and i/r ports		■	■
Modbus RTU slave on serial, modem, and i/r ports	■	■	■
Modbus TCP through Ethernet port	■	■	■
EtherGate data transfer between Ethernet & RS-485		■	■
ModemGate data transfer between internal modem & RS-485		■	■
MeterM@il, logged data alarms via email[1]		■	■
WebMeter, onboard web server	■	■	■
Analog inputs/analog outputs	4/4	4/4	4/4
Digital status inputs/counter		4	4
Digital relay outputs	4	4	4
Setpoints, alarming, and control			
Setpoints, number/minimum response time		1 sec	1 sec
Math, logic, trig, log, linearisation formulas		■	■
Single & multi-condition alarms		■	■
Call-out on alarms			■
Other metering functions			
MV-90 on serial, Ethernet ports		■	■
Multi-year scheduling: hourly activity profiles		■	■

1 ION7330 and ION7350 models only

2007

FROST & SULLIVAN

North American Frost & Sullivan Award for Product Innovation

The 2007 award recognizes Schneider Electric for its technological advancements and wide product range in the field of power quality (PQ) and energy management solutions. In total, this is the fourth award that Schneider Electric and [recently acquired] Power Measurement have received from Frost & Sullivan in recognition of achievements in this arena.
Prithvi Raj, Frost & Sullivan research analyst

c UL us LISTED DIGITAL POWER METER 20SJ

Certified System ISO 9001 QMI-SAI Global File# 002188

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Power Switching & Controls
for Business-Critical Continuity

ASCO 7000 SERIES Soft Load Power Transfer Switches

ASCO®

EMERSON™
Network Power

Protecting data centers, hospitals, airports, retail stores and other facilities

The ASCO 7000 Series Closed-Transition Soft Load Power Transfer Switch gives you the flexibility to:

- Ensure the level of power reliability required by your operations or process
- Switch critical loads between live utility and onsite power sources seamlessly
- Maintain parallel operation of both power sources
- Assure emergency transfer operation upon utility power failure
- Satisfy a broad range of power applications
- Reduce energy costs by shaving your facility's peak energy demand
- Export/import power to/from the electric utility
- Capitalize on the benefits of remote command and control
- Manage energy use more efficiently

Whatever your application, the ASCO 7000 Series Soft Load Power Transfer Switch can meet your load transfer requirements with an unsurpassed range of features and benefits.

The ASCO 7000 Series Soft Load Power Transfer Switch:

- Seamlessly transfers loads between acceptable utility power and onsite generation with virtually no voltage or frequency transients
- Transfers power using proven ASCO Closed-Transition Transfer Switches (CTTS)
- Automatically selects emergency standby transfer operation upon loss of utility power
- Enables you to monitor and control soft load operation using GUIs (graphical user interfaces) with user-friendly, pull-down menus
- Actively synchronizes the onsite generating unit to the utility source by automatically adjusting the generating unit's governor and voltage regulator (analog or pulse width modulated outputs control the governor)
- Actively controls generator kW and power factor during parallel operation
- Contains protective functions on utility and generator sources required for ongoing parallel operation
- Allows you to activate protective functions using the touch screen (each function can be programmed to signal an external breaker and/or alarm signal, or just display the condition on the GUI)
- Maximizes security with multiple levels of password protection
- Records and time stamps events and all changes to protective function settings
- Provides digital inputs with adjustable trip and reset time delays to control or monitor external devices
- Is available in 150 – 4000 amperes
- Listed to UL 1008, the industry safety standard for transfer switch equipment

24-hour protection no matter when trouble strikes

Synchronizing Power Ensures Continuity

The ASCO 7000 Series Soft Load Power Transfer Switch synchronizes and parallels two independent power sources, without interrupting power flow. The switch can be programmed to either maintain parallel operation of both power sources, or transfer the load to the onsite generating unit, avoiding transients caused by block loading.

Coupled with Web-enabled ASCO POWERQUEST® command and control, the Soft Load Power Transfer Switch enables you to use your onsite generation unit for soft load transferring, base loading, importing or exporting.

Soft Load Power Transferring

In the soft load power transfer mode, the transfer switch synchronizes and parallels the onsite generating unit to the utility source, then immediately instructs the generating unit to assume a preset load value (Gen Minimum Load Setpoint). The Soft Load Controller then continues to control generator excitation to the preset power factor setting. It begins increasing load on the engine at a preset ramp time rate. At the point the load on the utility source drops to the cutoff value, the switch disconnects the utility feeder.

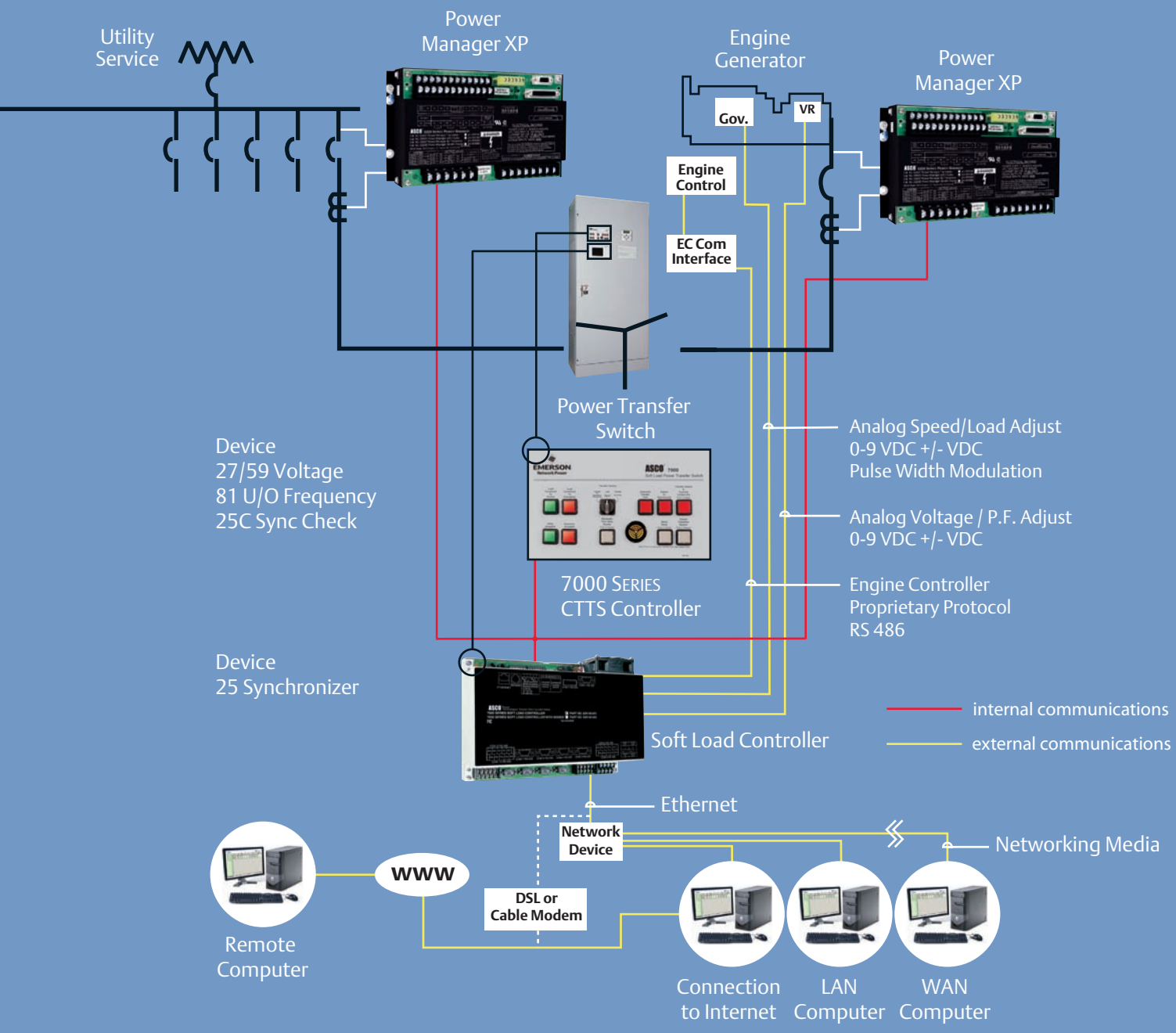
Continuous Base Loading

In the base loading mode, the generating unit operates continuously in parallel with the utility source until operation is discontinued on command. While operating, the soft load controller holds the load and power factor to the generating unit constant. Load variations are carried by the utility source. The switch retransfers the load to the utility source if the generating unit malfunctions.

Power Importing or Exporting

In the importing or exporting modes, the power transfer switch maintains the generating unit in parallel with the utility source. The switch's Soft Load Controller instructs the generating unit to produce the required output and varies the load on the unit to maintain the set import or export level. Load variations are carried by the generating unit up to the maximum generator load setting.

If either the utility or generator power fails in any of the modes, the load automatically transfers to the available source.

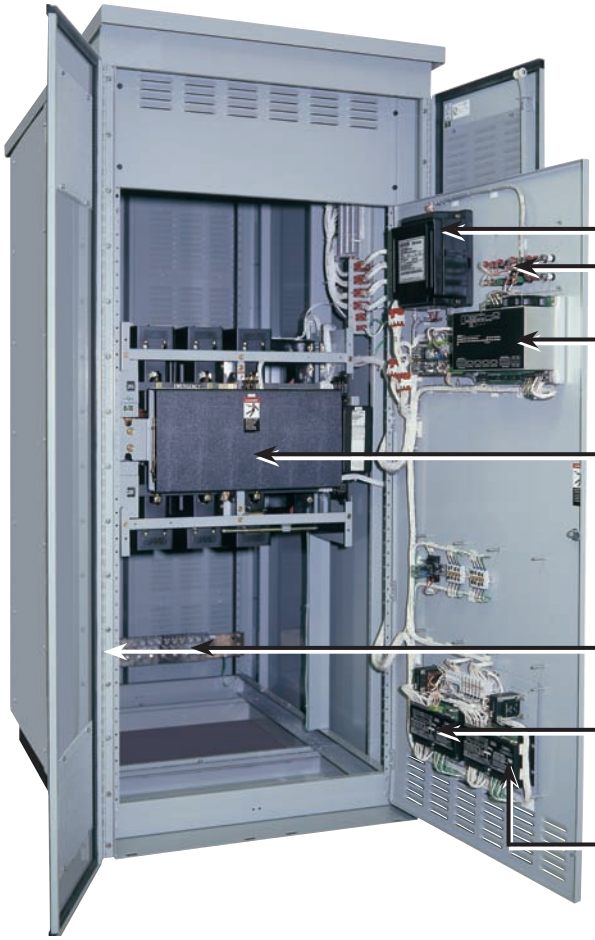


ASCO POWERQUEST® enables remote communications

The transfer switch schematic illustrates communications paths that enable users to remotely monitor and control operation of the Closed-Transition Soft Load Power Transfer Switch with ASCO's exclusive POWERQUEST® command and control connectivity. End users can monitor system status, load management settings, event logs and alarms from anywhere in the world, and receive e-mail paging for alarm signals. Communications paths include Internet, intranet, and/or Modbus networks via Ethernet, serial and/or DSL, or cable modem interfaces.

ASCO is the global leader in power switching and controls

ASCO 7000 Series Closed-Transition Soft Load Power Transfer Switch



Both the Closed-Transition Soft Load Power Transfer Switch and the Bypass-Isolation Soft Load Power Transfer Switch feature identical electrical ratings and heavy-duty mechanical interlocks that assure proper operation. The transfer switches feature a family of innovative electronic components that help make the switches the most advanced in the world.

Above switch rated 3000 amps in a Type 3R outdoor enclosure typically used with a 2 MW gen-set

ASCO power transfer switches—the standard of the industry—synchronize and parallel generation and utility power, allowing critical load transfers without momentary outages or surges.

Overlapping main electrical contacts using a reliable and field-proven solenoid operating mechanism enable make-before-break transfers that help ensure continuous power. Control logic continuously monitors power source conditions and automatically determines whether the load transfer should be open (conventional, non-overlap mode), or closed transition. Failure to synchronize indication and extended parallel time protection is built in to prevent abnormal operation.

7000 Series power transfer switches are available in ampacity sizes of 150 – 4000.

Critical Loads Demand ASCO

ASCO 7000 Series Soft Load Power Transfer Switch with Bypass-Isolation

Above Switch rated 2000 amps in a Type 3R outdoor enclosure

The ASCO 7000 Series Closed-Transition Soft Load Power Transfer Switch with bypass-isolation switching allows the switch to be inspected, tested and maintained without interrupting power, whether it's being provided from the utility or onsite generator.

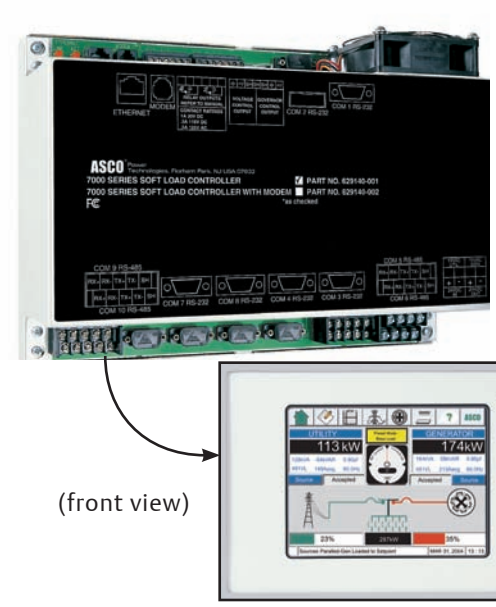
A drawout mechanism power transfer switch helps ensure ease of service and maintenance. Simple bypass and isolation functions require only two operating handles. Bypass contacts carry current only during the bypass mode.

The bypass switch has dead front quick-make, quick-break operation for transferring loads between live sources. It is fully rated for use as a manual three-position emergency power transfer switch in the event of a utility power failure when the transfer switch is in the isolated position.
It is available in ampacity sizes of 150 – 4000.

Creative, responsive, customer - focused and competitive.

Advanced Power Control and Monitoring

7000 Series Soft Load Controller



The Soft Load Controller is an industrial computer for controlling all soft load and parallel operation. The Controller communicates with the power transfer switch, controller, utility and generator Power Managers, engine-generator set controls, remote ASCO POWERQUEST® clients and facility supervisory control and data acquisition (SCADA) systems. This component:

- Actively controls engine generator output voltage and speed to synchronize the onsite power source with utility power (Device 25)
- Includes analog and PWM (pulse width modulated) outputs for controlling engine speed/loading and analog output for generator voltage/power factor
- Includes communication ports that provide Internet and intranet access for status checks and remote control
- Records and displays a time-and-date-stamped log of all system events and alarms (including those caused by protective trip functions)
- Includes a GUI (graphical user interface) for system set up, monitoring, and control

5200 Series Power Manager XP

Two Power Managers, one each dedicated to utility and onsite power sources, provide protective relay functions for reliable parallel operation of the sources. The power managers include digital inputs and outputs (Device 86).

In addition to directional power, a directional overcurrent device provides the most reliable protection against undesirable backfeeding of onsite power to the utility grid.

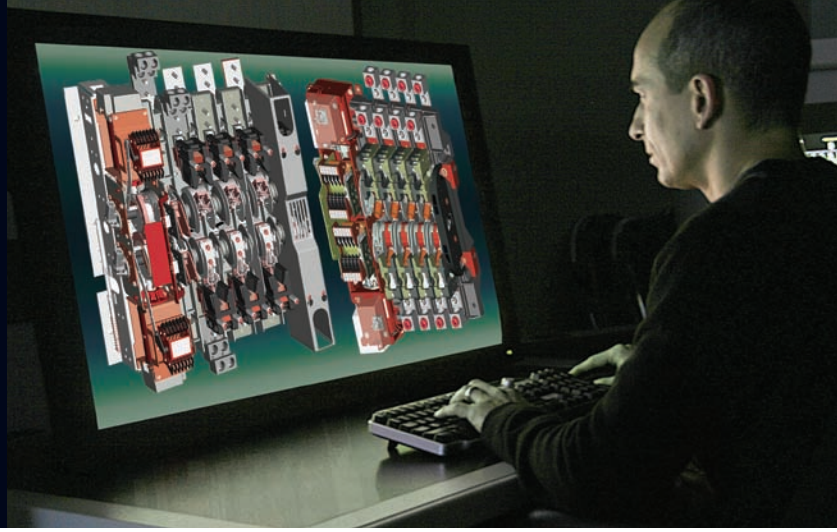
Utility Source Power Manager

- Device 27/59 Under and over voltage
- Device 32 Directional power
- Device 46 - Negative sequence overcurrent
- Device 47 - Negative sequence voltage
- Device 67 - Directional overcurrent
- Device 81 - Under and over frequency
- Device 86 - Lockout relay

Generator Source Power Manager

- Device 27/59 - Under and over voltage
- Device 32 - Directional power
- Device 40 - Loss of excitation (excess VARs)
- Device 81 - Under and over frequency
- Device 86 - Lockout relay

World-class technology for reliable power transfer



Control Interfaces

7000 Series User Control and Indicator Panel

The panel organizes a three-position selector switch for "Auto," "Soft Load Transfer" and "Transfer Preset" operation and LED status indicators.

AUTO
is the normal setting for automatic soft load transfers initiated remotely.

SOFT LOAD TRANSFER manually selects the soft load mode of operation regardless of the settings in the soft load power transfer controller. The time in the parallel position is based on the generator load/unload ramp time setting.

TRANSFER PRESET
manually initiates a soft load power transfer based on the soft load controller settings (base loading, soft load transferring or importing/exporting).

Additional controls enable users to set bypass time delays and reset alarms.

Microprocessor-Based Controllers

The Controller—the most advanced digital controller in the industry—automatically starts the engine and controls load transfer to an onsite power source in the event of a utility power outage. If the onsite power source fails, it automatically transfers the load to the utility power source in an open transition mode.

It includes all voltage, frequency, control and timing functions required for emergency and standby power applications.

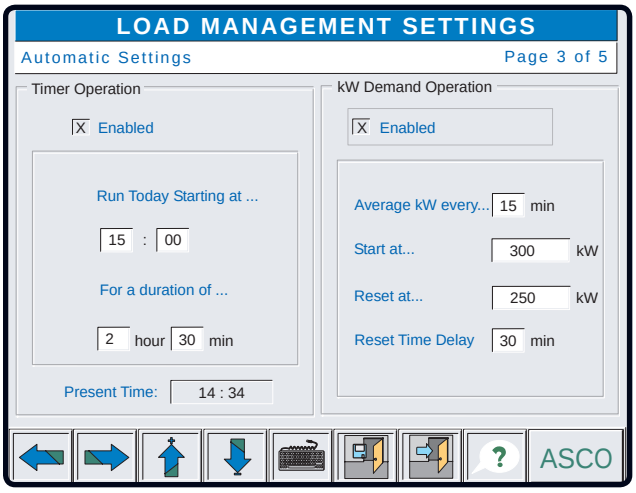
Touch pad programming establishes all operational settings and features, without the need for meters or variable power supplies.

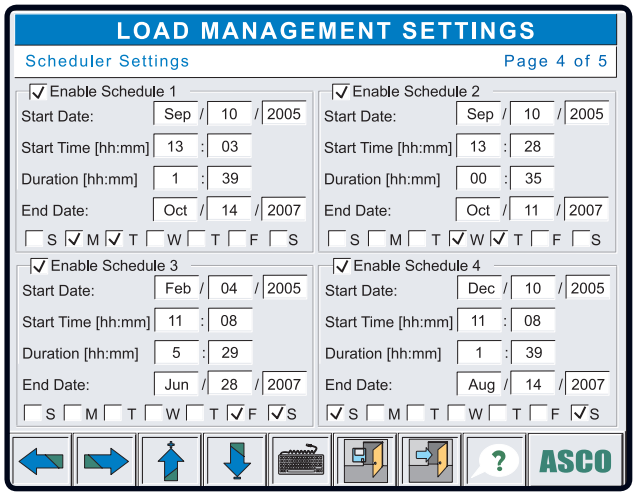
On-board diagnostics provide control panel and automatic transfer switch status information to analyze system performance. Password protection prevents unauthorized use.

The microprocessor logic board is separated and isolated from the power board to improve electrical noise immunity performance and to help assure compliance with rigorous transient suppression standards.(See page 12 for standards compliance chart.)

Ensure continuous
power for your operations

7000 Series Soft Load Graphical User Interface Panels

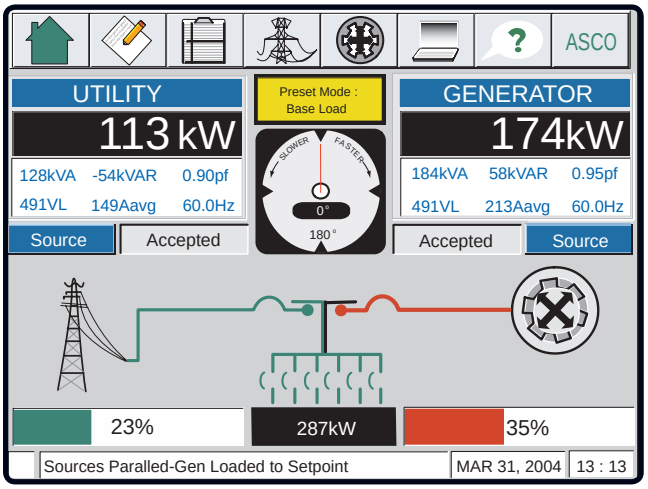




The intuitive, touch-screen GUI (graphical user interface) Panel displays at-a-glance operational status and enables users to set, monitor and control all functions quickly and easily. Menu bars simplify and speed navigation.

This screen shows that soft load transfer can be initiated automatically at a preset time or level of integrated kW demand. With a time-of-day setting, the operating mode would continue for a prescribed duration. With a kW demand setting, the operating mode would continue until kW demand dropped below the preset kW level. Selecting both time- of-day and kW integrated settings enables either setting to initiate operation, but both settings must be satisfied before operation can be terminated automatically.

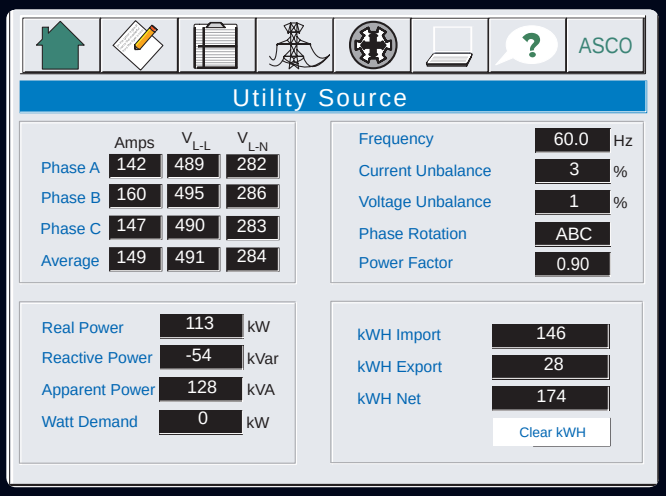
The Home Screen, Source Summary Screen, Load Management Settings Screen and Event Log Screen illustrate the range of data available through the panel. More than 50 screens provide users with total control and access to information on every aspect of system operation.



7000 Series Home Screen

This screen includes a synchroscope representation that shows the relative phase angle between the two sources of power. This screen also displays:

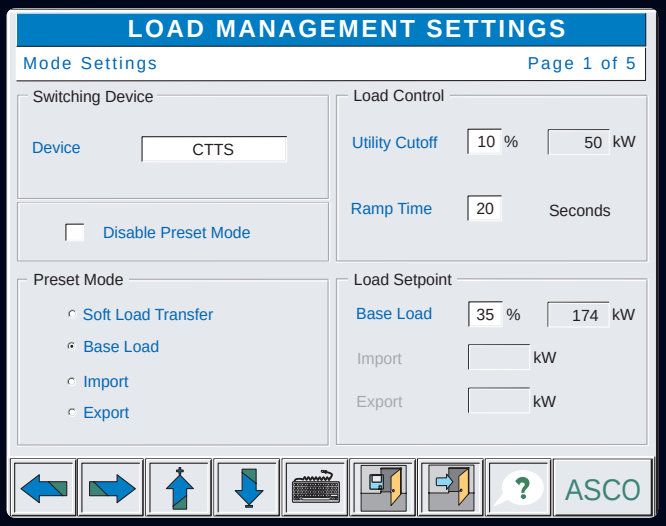
- Phase-to-phase voltage, frequency, current, kW, kVA and kVAR for each power source
- Percent of load being supplied from each source
- Load kW and system status
- Power transfer switch position
- Preset mode of operation
- Open or closed position of both power source breakers



7000 Series Source Summary Screen

A screen for each power source shows detailed displays of a variety of electrical parameters:

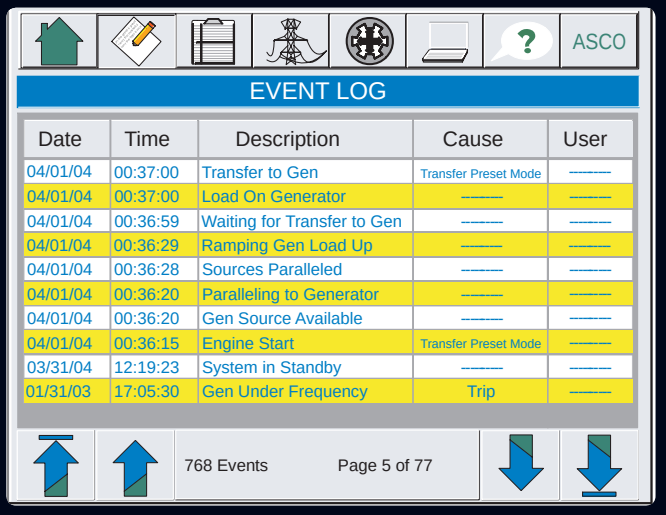
- Phase voltages and currents, line-neutral voltages, average phase voltage and current
- Voltage and current unbalances
- Phase voltage
- Frequency and power factor
- Utility source import and export kWh
- Power source kW, kVA and kVAR



7000 Series Load Management Settings Screen

A series of system configuration screens, such as this one, enable users to set system parameters, protective control functions and eight programmable user inputs for alarming or signaling conditions of external devices. Multiple levels of password protection control access to the screens. Users can use this screen to set:

- System operation—soft load transferring, base loading or importing/ex-porting modes
- Soft load ramp time
- Utility power cutoff setpoint
- Base load kilowatt setpoint
- Import or export kilowatt setpoint



7000 Series Event Log Screen

This screen displays any of the last 1000 events that are automatically time-and-date stamped and saved in an historical database. The event log saves all user acknowledgements, including the ID of the acknowledging user. Event categories cover:

- Transfer switch status, including transfers to the onsite power or utility sources
- Utility and onsite power source status, including tripping of protective functions, exceeding system setpoints, acceptance of permissive setpoints and status of user-defined discrete inputs, and feeder circuit breaker status
- Engine generator status, including engine start/stop and user-defined engine alarms and shutdowns

Ordering Information

ASCO 7000 Series

Closed-Transition Soft Load Transfer Switch

The sample catalog number below is 7ASLSA3400N5C

To order an ASCO 7000 Series Closed-Transition Soft Load Transfer Switch, use the following sample catalog number for the switch you want:

7	A	SLS	+	A	+	3	+	400	+	N	+	5	+	C
		Product		Neutral Code*		Phase Poles		Amperes Code		Voltage Code		Grp		Cabinet
A	Automatic	SLS	Soft Load Closed-Transition	—	No Neutral	3		150	C	208			C	Type 1 enclosure
								260	D	220		5X-		
				A	Solid			400	E	230		optional	M	Type 3R secure
		SLB	Soft Load W/Bypass-Isolation Switch		Neutral			600	F	240		accessories		enclosure
				B	Switched Neutral			800	L	440				
								1000	M	460				
				C	Overlapping Neutral			1200	N	480				
								1600	P	550				
								2000	Q	575				
								3000	R	600				
								4000						

*Note: Specify neutral code B (optional) on switches rated 150-3000 amps and neutral code C on switches rated 4000 amps.

ASCO 7000 Series
Microprocessor-Based Controllers

Transient Suppression Standards Compliance

Emission Standard – Group 1, Class A	FCC Part 15, Class A
Generic Immunity Standard, from which:	EN 50082-2:1995
Electrostatic Discharge (ESD) Immunity	EN 61000-4-2:1995
Radiated Electromagnetic Field Immunity	FCC Part 15, Class A
Electrical Fast Transient (EFT) Immunity	EN 61000-4-4:1995
Surge Transient Immunity	EN 61000-4-5:1995
Conducted Radio-Frequency Field Immunity	EN 61000-4-6:1996
Voltage Dips, Interruptions and Variations Immunity	EN 61000-4-11:1994

ASCO 7000 Series
Closed-Transition Soft Load Transfer Switch Terminals

Sizes of UL-Listed Solderless Screw-Type Terminals for External Power Connections

Switch Rating Amps	Max. # of Conductors per Terminal	Range of AL-CU Conductor Sizes
150, 260, 400	One	#4 AWG to 600 MCM
600	Two	#1/0 AWG to 600 MCM
800 – 1200	Four	#1/0 AWG to 600 MCM
1600 – 2000	Six	#1/0 AWG to 600 MCM
3000 – 4000	Twelve	#1/0 AWG to 600 MCM

ASCO 7000 Series
Bypass-Isolation Soft Load Transfer Switch Terminals

Sizes of UL-Listed Solderless Screw-Type Terminals for External Power Connections

Switch Rating Amps	Max. # of Conductors per Terminal	Range of AL-CU Conductor Sizes
150, 260, 400	One	#4 to 600 AWG
600 – 800	Three	#2 AWG to 600 MCM
1000 – 1200	Four	#1/0 AWG to 600 MCM
1600 – 2000	Six	#1/0 AWG to 600 MCM
3000	Ten	#1/0 AWG to 600 MCM
4000	Twelve	#1/0 AWG to 600 MCM

Dimensions

ASCO 7000 Series Closed-Transition Soft Load Transfer Switch Dimensions[6]

Switch Rating amps	Poles	Width inches (mm)	Height inches (mm)	Depth inches (mm)
Enclosed UL Type 1 (Consult ASCO for Type 3R dimensions.)				
150, 260, 400[1]	3 or 3 with neutral A/B	24 (610)	56 (1422)	14 (356)
600	3 or 3 with neutral A/B	24 (610)	63 (1600)	17 (432)
800, 1000	3 or 3 with neutral A/B	34 (864)	72 (1829)	20 (508)
1200	3 or 3 with neutral A/B	38 (965)	87 (2210)	23 (584)
1600 – 2000[2]	3 or 3 with neutral A/B	38 (965)	91 (2311)	48 (1219)
1600 – 2000[2] (front connected)	3 or 3 with neutral A/B	38 (965)	87 (2210)	23 (584)
3000[2]	3 or 3 with neutral A/B	38 (965)	91 (2311)	60 (1524)
4000[2]	3 or 3 with neutral A/B	60 (1524)	70 (1778)	53 (1272)

ASCO 7000 Series Bypass-Isolation Soft Load Transfer Switch Dimensions[6]

Switch Rating amps	Power Connection Configuration	Poles	Width inches (mm)	Height inches (mm)	Depth inches (mm)
Enclosed UL Type 1 (Consult ASCO for Type 3R dimensions.)					
150, 200, 230, 260, 400, 600[1]	Front Connected	3 or 3 with neutral A/B	34 (864)	85 (2159)	28 (711)
800[1,3]	Front Connected	3 or 3 with neutral A/B	38 (965)	91 (2311)	32 (813)
800, 1000, 1200[1,2]	Side/Rear Connected	3 or 3 with neutral A/B	38 (965)	91 (2311)	48 (1219)
1600 – 2000[1,2]	Side/Rear Connected	3 or 3 with neutral A/B	38 (965)	91 (2311)	60 (1524)
3000[1,2]	Side/Rear Connected	3 or 3 with neutral A/B	38 (965)	91 (2311)	72 (1829)
4000[2]	Rear Connected	3 or 3 with neutral A/B	60 (1524)	91 (2311)	96 (2438)

Notes:

1. Handles extend 6-1/4 inches (159mm).
2. Recommended clearance to enclosure: 3 feet (914mm) from rear, 4 feet (1219mm) from front (25 inches required for transfer switch drawout). Side or rear access required.
3. Conventional switched neutral is provided on 7A DTB and 7N DTB switching arrangements when specified (optional Code B).
4. Specify optional accessory 40HY for 600 amp front-connected arrangement and 40JY for 800 amp. All service and load capabilities limited to top entry only.
5. Contact ASCO for details.
6. All dimensions shown are approximate and should not be used for construction purposes. Certified dimensions can be furnished upon request.

ASCO 7000 Series

Closed-Transition Soft Load Transfer Switch Shipping Weights

*(Export shipments may require a wooden box. Contact ASCO for weights and dimensions. Consult ASCO for Type 3R shipping weights.)

Switch Rating amps	Poles	Type 1* Enclosure
150, 260, 400	3	325 (148)
150, 260, 400	3 with B	335 (152)
600	3	425(193)
600	3 with B	435(198)
800, 1000	3	510 (231)
800, 1000	3 with B	540 (244)
1200	3	800 (362)
1200	3 with B	830 (375)
1600 – 2000	3	1410 (637)
1600 – 2000	3 with B	1460 (660)
3000	3	2210 (998)
3000	3 with B	2280 (1031)
4000	3	2239 (1012)
4000	3 with B	2413 (1093)

ASCO 7000 Series

Bypass-Isolation Soft Load Transfer Switch Shipping Weights

*(Export shipments may require a wooden box. Contact ASCO for weights and dimensions. Consult ASCO for Type 3R shipping weights.)

Switch Rating amps	Poles	Type 1* Enclosure
150, 260, 400, 600	3	1140 (518)
150, 260, 400, 600	3 with B	1200 (545)
800, 1000, 1200	3	1680 (762)
800, 1000, 1200	3 with B	1750 (794)
1600 – 2000	3	2495 (1132)
1600 – 2000	3 with B	2675 (1213)
3000	3	2830 (1276)
3000	3 with B	3460 (1560)
3000	3	6300 (2858)
4000	3 with B	6900 (3130)

ASCO Power Technologies®

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- Surge Protection

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EMERSON. CONSIDER IT SOLVED.™

Galaxy PW

100, 130, 150, 180, 200, 225 KVA

Next Generation Critical Power Protection System

After considerable success worldwide, MGE is pleased to introduce the Galaxy PW for the North American market. The Galaxy PW's popularity is not only due to it's exceptional reliability track record but also due to its modular design that permits the paralleling of modules for capacity or redundancy without extra paralleling gear. The Galaxy PW can also be field upgraded up to 225 kVA addressing smaller increases in power requirements without incurring the cost of another UPS module. Providing up to 225 kVA/200 kW in a space saving 11 square feet, the Galaxy PW has one of the highest power densities available complimented by a 0.9+ output factor to perfectly match load profiles.

Built on the reliability of the original Galaxy PW, the next generation PW offers improvements including generator friendly topology to avoid excessive generator over-sizing requirements. Other notable features include a user friendly operator interface, high energy efficiency, and advanced battery management system with automated self testing, alerting you to battery performance issues before they have a chance to affect UPS reliability.

Installed in over 5000 critical applications, the Galaxy PW *is the right choice for your power protection needs.*

THE UNINTERRUPTIBLE POWER PROVIDER

Advanced Features

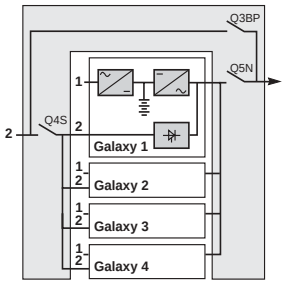
- 0.9 Output Power Factor
- Modular Design for Easy Upgrading or Expansion
- Parallel Modules for Capacity or Redundancy
- Field Upgradeable Power Output**
- Low kVAR Input Filter
- Generator Friendly for Low UPS to Generator Sizing Ratios
- Proven Reliability in over 5,000 Installations
- Advanced Battery Management System with Automatic Self Testing
- Front Access Design
- Small Footprint/Very High Power Density
- Simple, Secure and Easy to Read Operator Interface
- Backed by MGE's 700 Field Service Engineers

** on 100-200 kVA modules only

MGE
UPS SYSTEMS

Galaxy PW - Redefining Power Quality

Scalable and Upgradeable Power



No additional paralleling gear required!

Simple and secure paralleling technology

Galaxy PW modules can be paralleled for redundancy or capacity simply by bussing the output of the modules together. All paralleling intelligence resides in each module for true redundancy. Up to three modules can be paralleled for capacity and four modules for redundancy. A system level wrap around maintenance bypass facilitates easy cable landing while providing a system level maintenance bypass. Internal maintenance bypasses on each UPS module allow each module to be isolated for maintenance.

Upgradeable Power Levels

The Galaxy PW is field upgradeable up to 225 kVA, providing the extra power you need without the expense of added equipment or installation costs.

Reliability Advantages

User Friendly Interface

A back-lit, wide-angle graphic display lets you scroll through clear messages presenting detailed information on diagnostics and UPS status. An event log tracks all alarm and events including UPS and battery lifecycle data. All alarms are clearly explained in detail to walk operators safely through any situation.

- LED Mimic Diagram
- Alarm Event Log
- Battery and UPS Cycle Monitor
- Self Diagnostic Report

Integrated Battery Diagnostics

Battery failure is the leading cause of UPS reliability issues. The Galaxy PW's integrated battery diagnostic system automatically performs periodic battery health tests, alerting operators to irregularities before they have a chance to affect UPS performance.

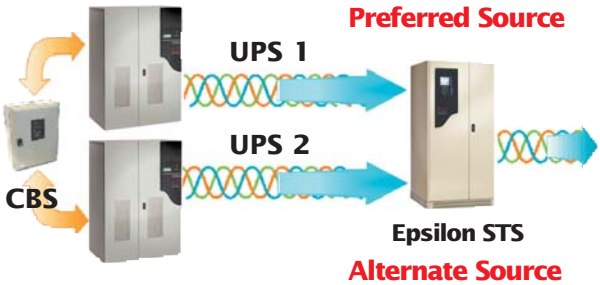
Generator Friendly

The Galaxy PW utilizes MGEs low KVAR filter to limit leading power factor on the input. This eliminates the need for costly generator oversizing and eliminates common UPS generator compatibility issues.

Galaxy PW Peripherals

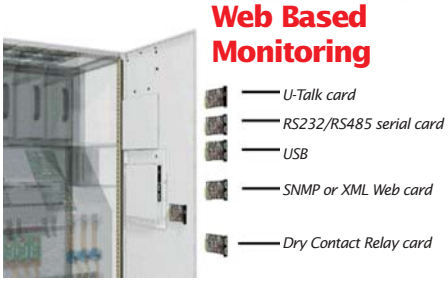
Critical Bus Synchronization

The Critical Bus Synchronization (CBS) module keeps the outputs of two UPS modules in sync with each other under all operating conditions. This assures a seamless transfer between UPS modules when using downstream static transfer switches.



Communication Solutions

From dry contact status relays, to web based status cards, the Galaxy PW can be equipped with any communication interface.



The Proven Solution

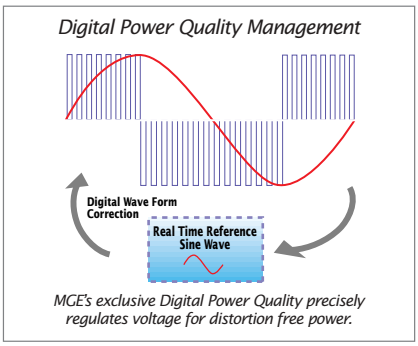
The sleek, modular design of the Galaxy PW has been proven reliable in over 5000 installations world wide prior to being offered in the North American market.

The Galaxy PW features:

- *A tried and tested 3rd generation electronic control architecture*
- *IGBT based inverter technology and innovative connector technologies to significantly reduce the number of PC boards and connections for improved reliability*
- *Integrated self protection features such as sub-cycle current limiting to protect the UPS against dead shorts*
- *Board level self diagnostics and auto calibration to ensure proper performance under all operating conditions*

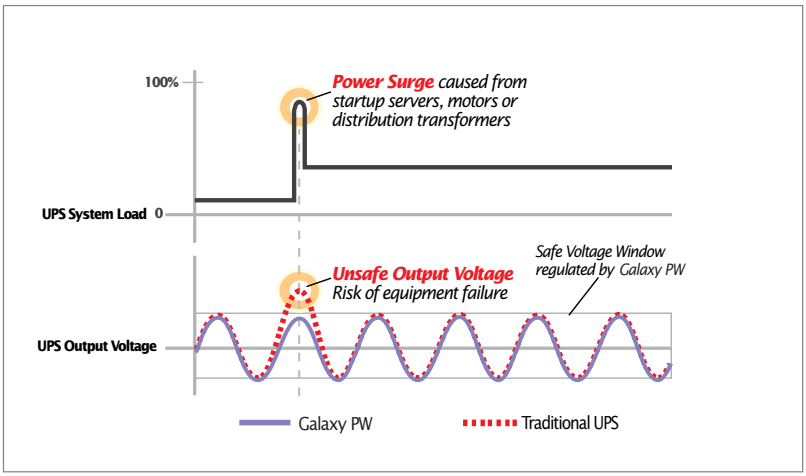
MGE Legendary IGBT inverter technology: *MGE pioneered the use of IGBT inverter technology for UPSs. The Galaxy PW uses third generation inverter technology that delivers precision voltage regulation under all operating conditions, total harmonic management and a robust design that protects the UPS from damage even in the event of a dead short.*

Precision Power Quality



Digital Power Quality Management

Perfect Power: The Galaxy PW uses MGE's Digital Power Quality (DPQ) technology to deliver precisely regulated, practically distortion free power under all operating conditions. DPQ technology compares the output wave form to a computer simulated wave form. Any imperfections are immediately corrected using tiny sub-cycle pulses maintaining a pure sine wave output under all load conditions.

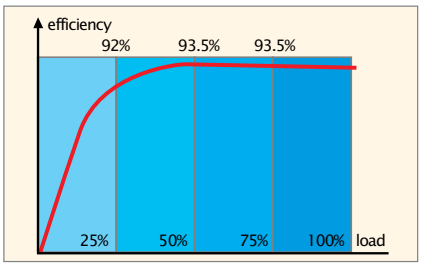


Excellent Transient Load Response

Under any circumstances, a UPS must be capable of instantly supplying its full rated load without affecting the voltage regulation. Galaxy PW can handle this demand without transfer to the bypass line, while maintaining the output voltage well within the tolerance limits demanded by sensitive equipment (±5% voltage variation for a 100% load step change).

Energy Efficiency – Cost Savings that Matters

A major factor in selecting a high-power UPS is its efficiency. The reason is simple, an efficiency advantage of only 3 to 4% over five years can represent a savings in electricity costs equivalent to half the cost of the UPS! Furthermore, most UPSs supply continuous average loads that amount to only 50 to 60% of their rated output, a level where their efficiency is far from optimum. Galaxy PW offers among the highest efficiency available in today's market and efficiency that remains virtually constant from 25 to 100% of rated power. The result is often a real cost savings that makes the Galaxy PW the least expensive choice in the long run.



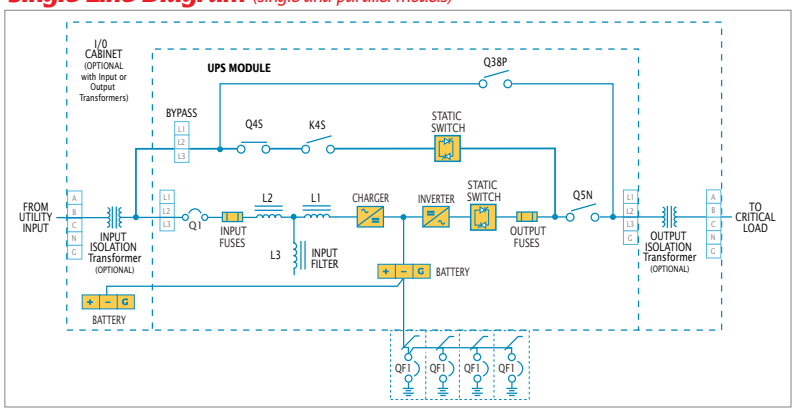
UPS Module Specifications

	100 kVA				130 kVA				150 kVA			
Input Voltage (V)	208	480	480	600	208	480	480	600	208	480	480	600
Output Voltage (V)	208	208	480	600	208	208	480	600	208	208	480	600
Nominal Input Current (A)	311	135	135	108	414	180	180	144	483	210	210	168
Maximum Input Current (A)	343	149	149	119	455	198	198	158	531	231	231	185
Nominal Output Current (A)	278	279	121	97	361	361	157	126	416	418	181	145
DC Current at Nominal Voltage (A)			219				283				331	
Efficiency at 100%			92.5%				93%				93%	
Full Load Heat Rejection (BTUs)			25600				31060				35840	
UPS Module Weight (lbs)			3050*				3050*				3050*	
Module Width (75"H x 33"D)			48"				48"				48"	

	180 kVA				200 kVA				225 kVA			
Input Voltage (V)	208	480	480	600	208	480	480	600	208	480	480	600
Output Voltage (V)	208	208	480	600	208	208	480	600	208	208	480	600
Nominal Input Current (A)	600	260	260	208	692	300	300	240	692	300	300	240
Maximum Input Current (A)	660	286	286	229	738	320	320	256	738	320	320	256
Nominal Output Current (A)	501	501	217	174	556	556	241	217	625	625	271	217
DC Current at Nominal Voltage (A)			392				438				442	
Efficiency at 100%			93%				93.5%				93.5%	
Full Load Heat Rejection (BTUs)			43000				44370				45000	
UPS Module Weight (lbs)			3050*				3050*				3050*	
Module Width (75"H x 33"D)			48"				48"				48"	

*UPS module only–does not include transformer and auxiliary cabinets

Single Line Diagram *(single and parallel models)*



Galaxy PW Battery Systems ~ Backup time in minutes at 100% load @ 0.8 power factor

Qty. Cabinets	Weight (lbs)	100 kVA		130 kVA		150 kVA		180 kVA		200 kVA		225 kVA		CB Rating
		0.8 PF	0.9 PF	0.8 PF	0.9 PF	0.8 PF	0.9 PF	0.8 PF	0.9 PF	0.8 PF	0.9 PF	0.8 PF	0.9 PF	
1	3,070	10	8	7	5	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	250 A
2	6,140	30	26	22	17	16	13	12	10	10	8	8	6	250 A
3	9,210	50	44	35	30	30	25	22	19	20	17	16	13	250 A
4	12,280	75	64	50	44	41	36	35	30	30	26	26	21	250 A
1	3,734	17	14	11	9	9	7	6	n/a	5	n/a	n/a	n/a	250 A
2	7,468	41	35	30	26	25	22	20	17	17	14	14	12	250 A
3	11,202	74	62	50	43	42	37	33	28	30	26	24	22	250 A
4	14,936	105	93	75	64	60	53	48	42	42	37	36	33	250 A
1	4,770	23	19	15	12	12	9	8	5	6	n/a	n/a	n/a	400 A
2	9,540	59	52	42	36	36	31	28	23	24	20	19	16	400 A
3	14,310	100	87	74	61	59	52	46	41	41	35	37	31	400 A
4	19,080	135	120	100	88	85	74	68	59	60	52	51	44	400 A

Battery System Features

- Individual cabinet dimensions: 75" H x 50" W x 33" D
- All cabinets have a standard internal battery disconnect
- Cabinets may be ordered adjacent to the UPS or remote available upon request
- Run time specifications are for 77 °F/25 °C and may differ with temperature
- Longer duration battery banks and wet cell batteries are available on request
- Above battery systems are housed in a matching enclosure
- All batteries specified above are sealed, low maintenance cells

Standard Features

- IGBT/PWM Inverter
- Low kVAR Input Filter
- LED Mimic Diagram
- Guided Operator Interface
- Advanced Battery Management System
- Modular Power Assemblies
- Front Access Design
- Computer Aided Self Diagnostics
- RS2323/485 Serial Interface
- Dry Contact Relay Status Array
- Top to Bottom Access Models

AC Electrical Characteristics

- Output Power Factor: ≥ 0.9
- Input Source: 208, 480, 600VAC 3PH, 3W + G (or 4W + G for Bypass)
- Output: 208, 480, 600VAC 3PH, 3W + G, or 4W + G
- Input Frequency Window: 60Hz/± 10%
- Inverter Sync. to Bypass: ± 0.5 Hz (adjustable from ± 0.25 Hz to ± 2 Hz)
- Input THDI: < 7.5% at 225 kVA
- Voltage Transient Response (at 100% Step Load): ± 2%
- Inverter Overload Capacity (A): 150% for 1 min.; 125% for 10 min.
- Bypass Instant Overload (1 cycle): 22 times nominal current
- THDV (linear loads): < 1.5% Ph/Ph, < 2.0% Ph/N
- THDV (non-linear loads): < 2.0% Ph/Ph, < 3.0% Ph/N
- Input Switch Q1: 400 A
- Bypass Input Contactor: 265 A (350 IEC)
- Bypass Switch(es) Q4S/Q38P/Q5N: 400A

DC Electrical Characteristics

- DC Nominal Voltage: 480 VDC
- Max. DC Float Voltage: 545 VDC
- Min. DC Cut-Off Voltage: 390 VDC

Environmental Characteristics

- Storage Temperature Range: -25ºC to +70ºC
- Operating Temperature Range: 0ºC to 40ºC
- Relative Humidity: 95% maximum
- Noise Level (dBA): 68

MGE UPS SYSTEMS THE UNINTERRUPTIBLE POWER PROVIDER

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1660 Scenic Avenue
Costa Mesa, CA 92626
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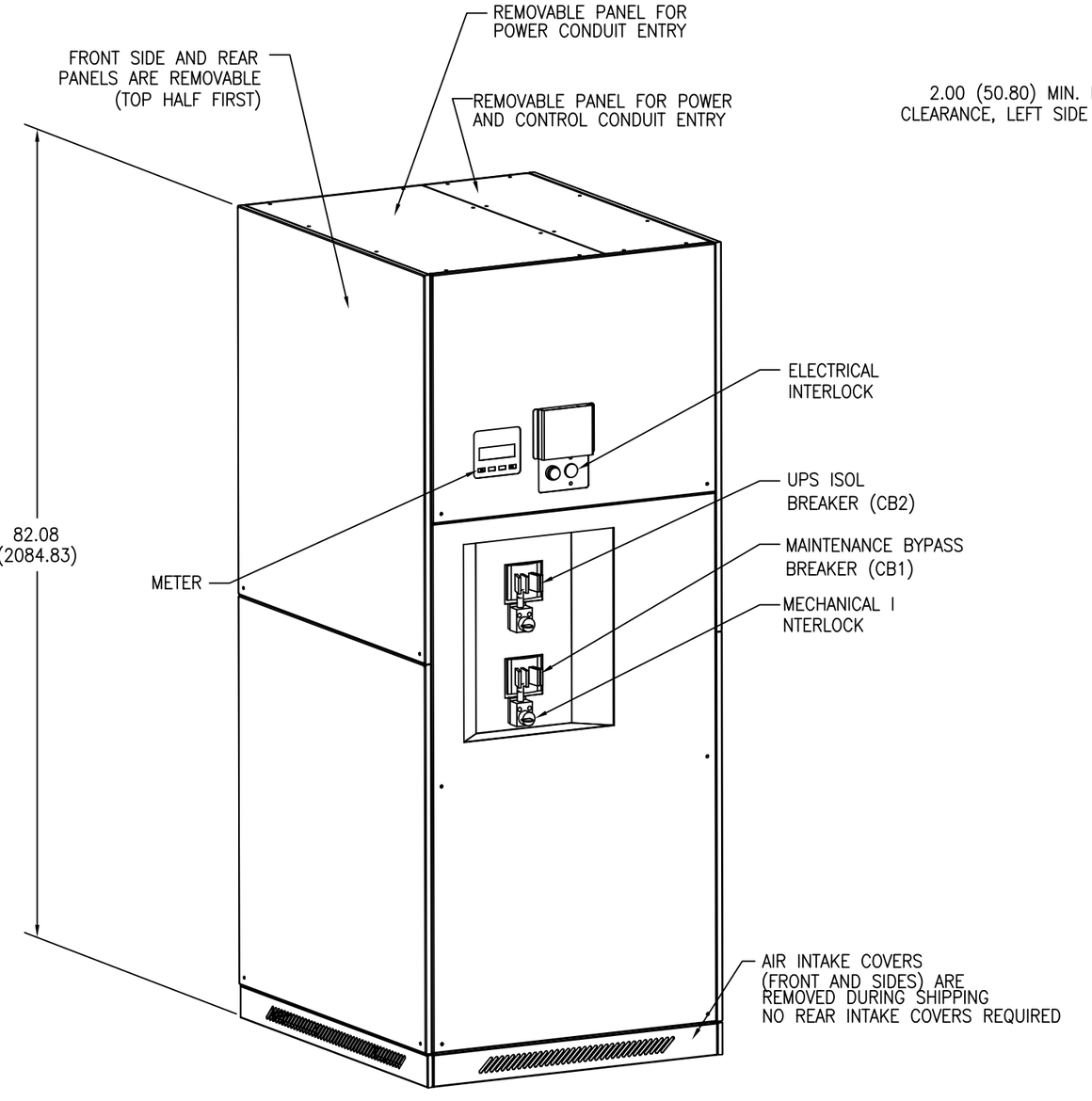
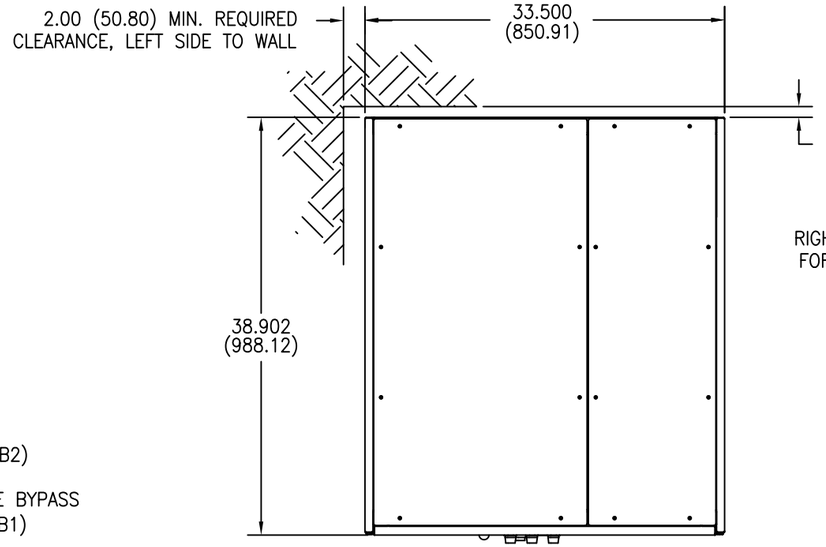
GX PW 100
Effective: October 2002



RECOMMENDED AISLE SPACE = 60.00(1525)



TOP VIEW

NO REAR CLEARANCE REQUIRED.

RIGHT SIDE ACCESS RECOMMENDED
FOR UPS CABLE INSTALLATION

1. DIMENSION FORMAT IS INCHES (MM). ALL DIMENSIONS ARE TO OUTSIDE EDGES OF THE CABINET, EXCLUDING HARDWARE, INTERLOCK, ETC.
2. A PHILLIPS SCREWDRIVER IS REQUIRED TO REMOVE EXTERNAL PANELS.
3. COLOR: MGE LIGHT GRAY (RAL 9002). AIR INTAKE COVERS (RAL 7038).
4. OPERATING TEMPERATURE: 32°F (0°C) MIN. TO 95°F (35°C) MAX. RECOMMENDED OPERATING RANGE: 6–0°F (15°C) TO 77°F (25°C).
5. AIR EXHAUST: NONE.
6. HEAT GENERATION: NEGLIGIBLE.
7. WEIGHT: 940 LBS.
8. REFER TO MGE DOCUMENT NO. 9–00038–00 FOR CABLE PREPARATION PROCEDURE FOR FIELD WIRING.
9. ALL EXTERNAL WIRING SUPPLIED AND CONNECTED BY CUSTOMER REFER TO THE INSTALLATION MANUAL FOR MORE DETAILS. CONTROL WIRES SHOULD BE ROUTED IN THE CONTROL WIRE CHANNEL PROVIDED BEHIND THE RIGHT FRONT FRAME (SEE SHEET 2).
10. REMOVE NEUTRAL–TO–GROUND BOND IN EACH PARALLEL UPS.
11. AVAILABLE RATINGS: 350A, 700A, 1200A, REF ASSY: 72–133077–00,– 35 AND –70.

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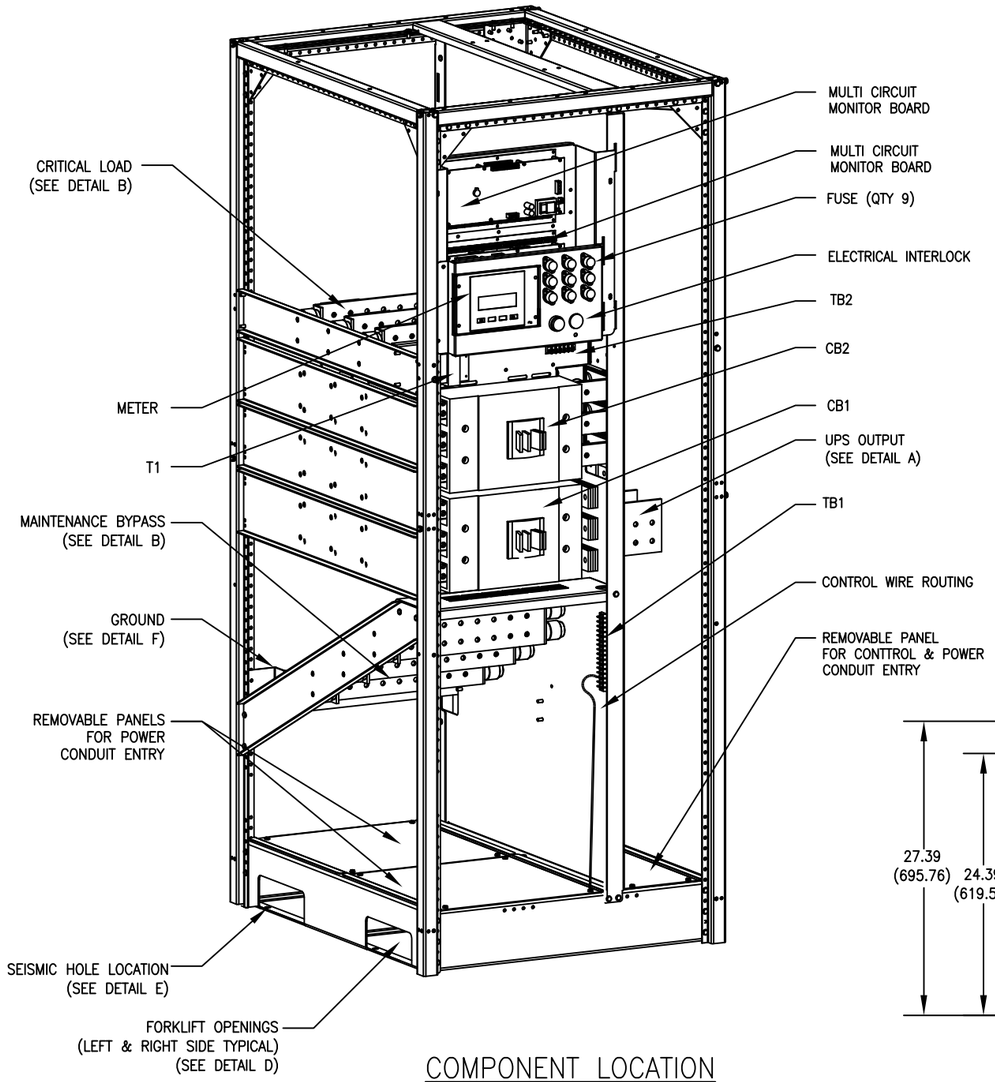
Schneider Electric

TITLE: GALAXY PW
100 TO 225kVA MBC
SYSTEM INSTALLATION

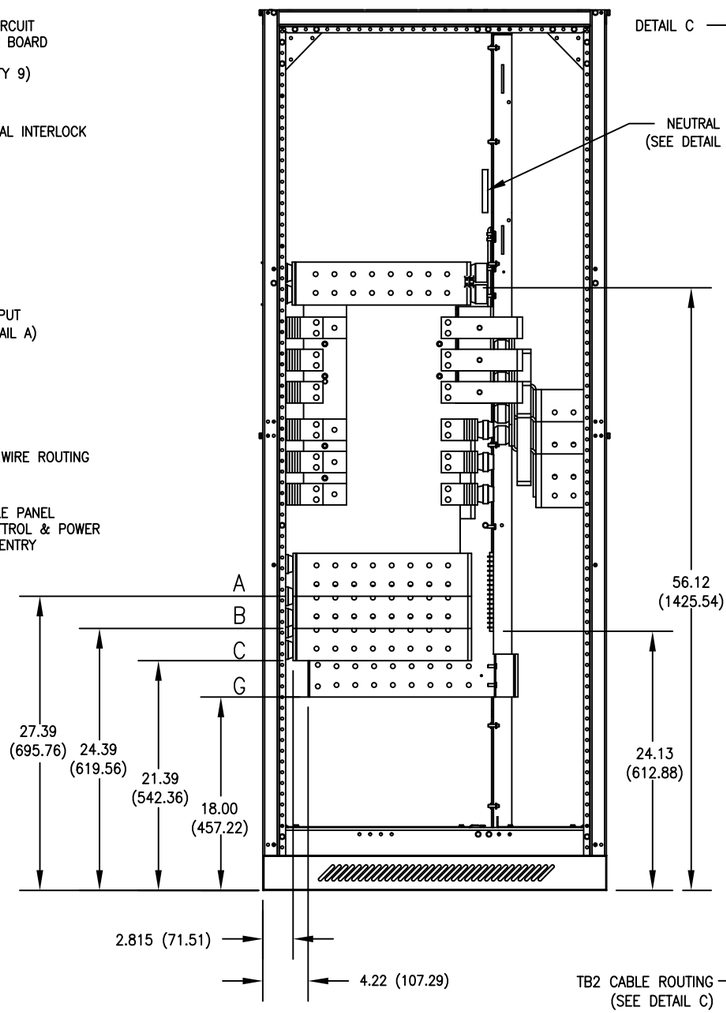
PROJECT: STD SUBMITTAL DRAWINGS | SHEET 1 OF 4

DWG NO: 90–133077–00			REV: A01
DRAWN:	H DINH	31–MAY–02	PROJ. ANGLE N/A
ENGINEER:	LNA	31–MAY–02	
APPROVED:	LNA	31–MAY–02	

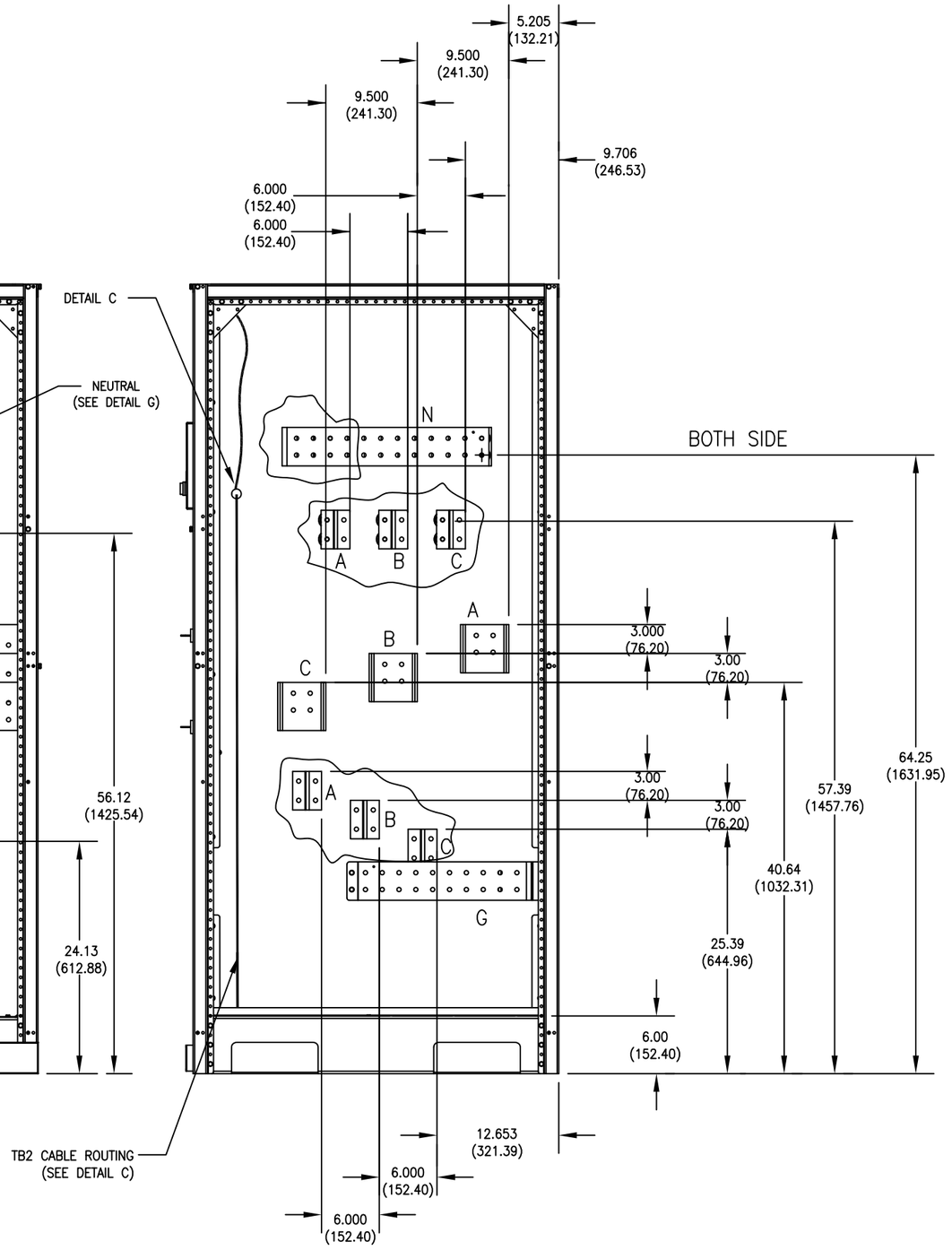


COMPONENT LOCATION

ALL EXTERNAL PANELS REMOVED FOR CLARITY



FRONT VIEW



RIGHT SIDE VIEW

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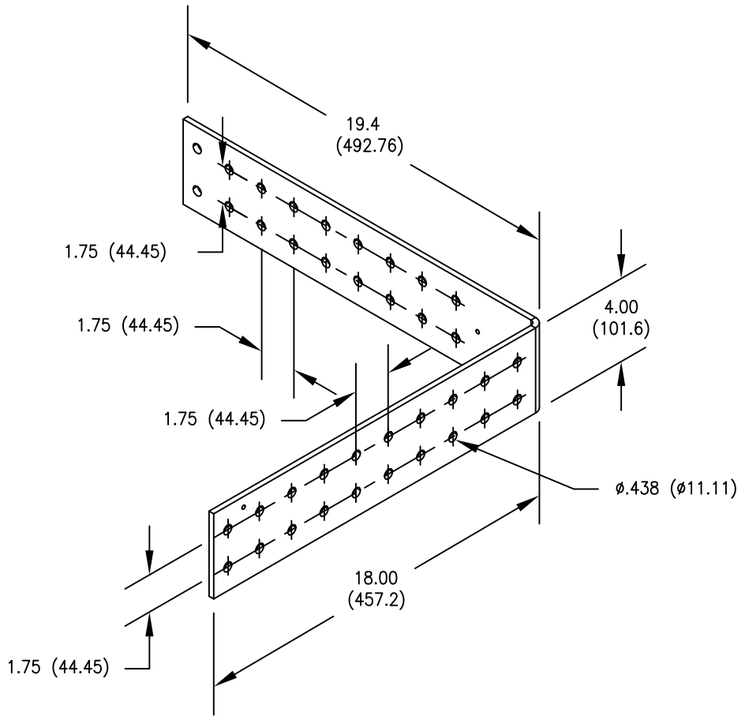
Schneider Electric

TITLE: GALAXY PW 100 TO 225kVA MBC SYSTEM INSTALLATION

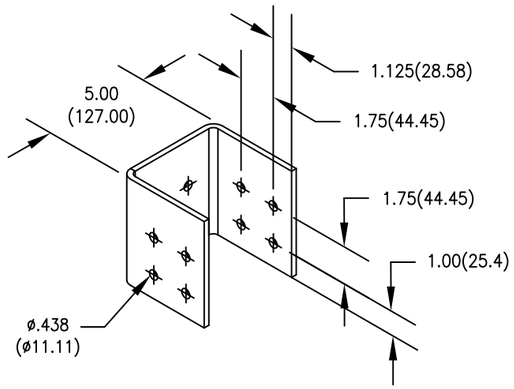
PROJECT: STD SUBMITTAL DRAWINGS | SHEET 2 OF 4

DWG NO: 90-133077-00			REV: A01
DRAWN:	H DINH	31-MAY-02	PROJ. ANGLE N/A
ENGINEER:	LNA	31-MAY-02	
APPROVED:	LNA	31-MAY-02	



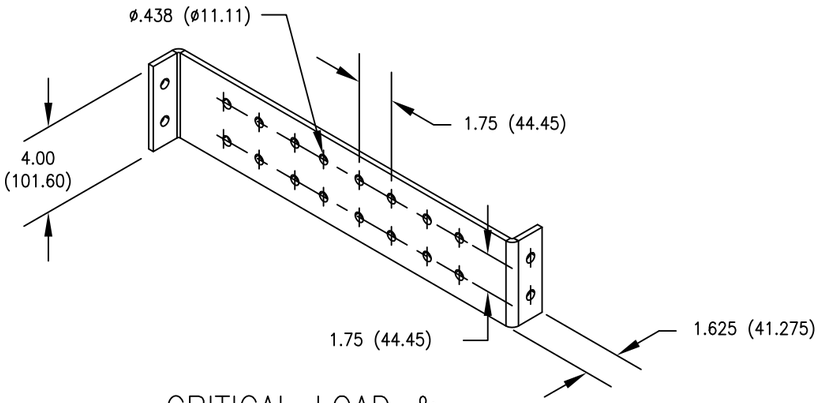
GROUND

DETAIL F



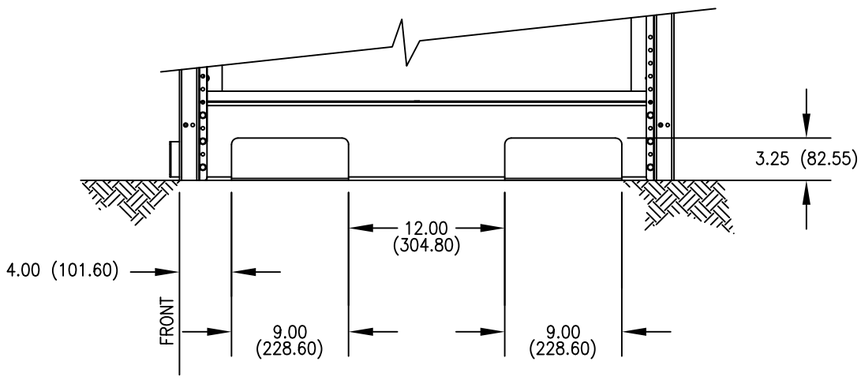
UPS CONNECTION

DETAIL A



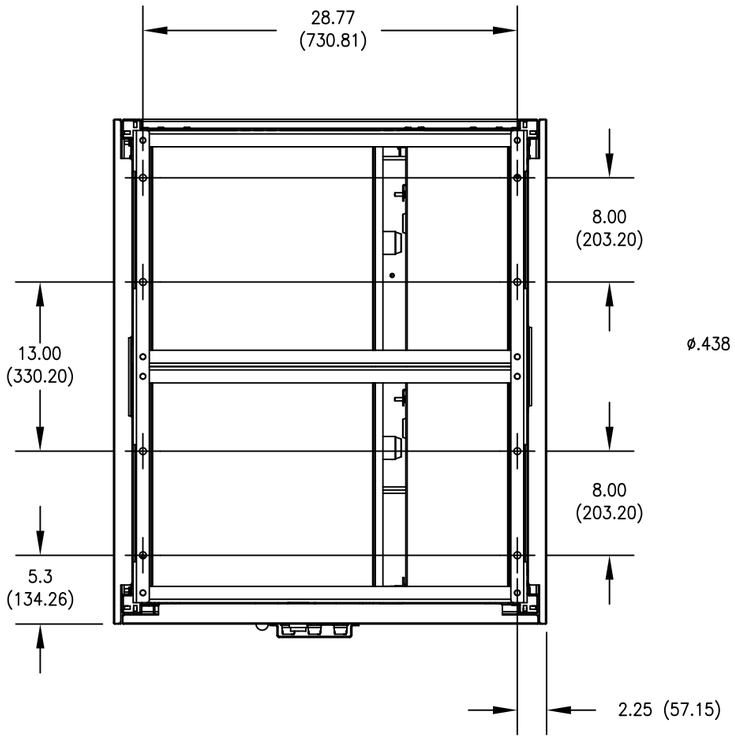
CRITICAL LOAD &
MAINTENANCE BYPASS

DETAIL B



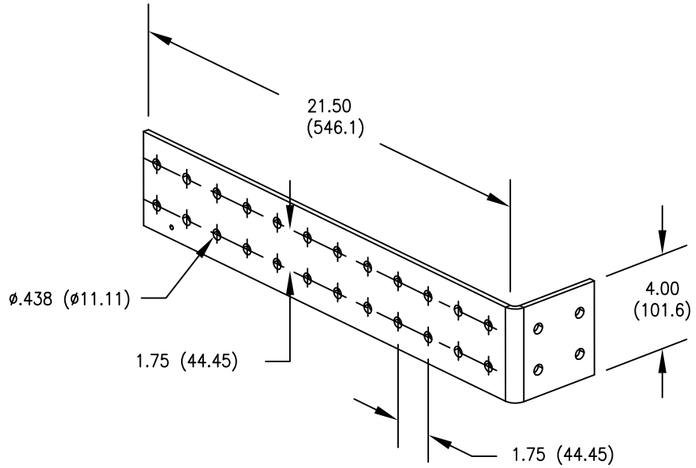
FORK LIFT CUTOUT

DETAIL D



SEISMIC BOLTING

DETAIL E



NEUTRAL

DETAIL G

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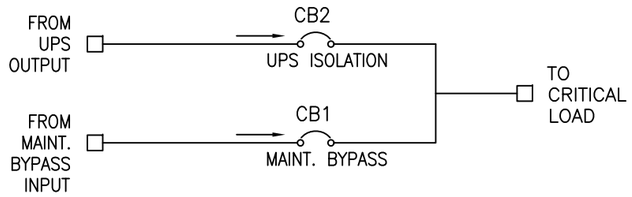
Schneider Electric

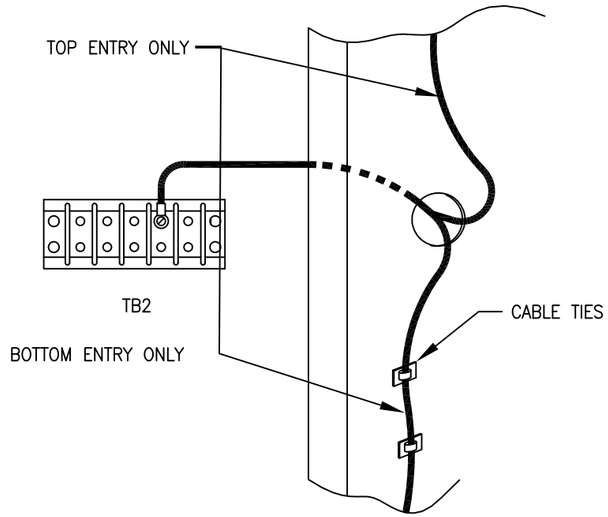
TITLE: GALAXY PW
100 TO 225kVA MBC
SYSTEM INSTALLATION

PROJECT: STD SUBMITTAL DRAWINGS | SHEET 3 OF 4

DWG NO: 90-133077-00			REV: A01
DRAWN:	H DINH	31-MAY-02	PROJ. ANGLE N/A
ENGINEER:	LNA	31-MAY-02	
APPROVED:	LNA	31-MAY-02	



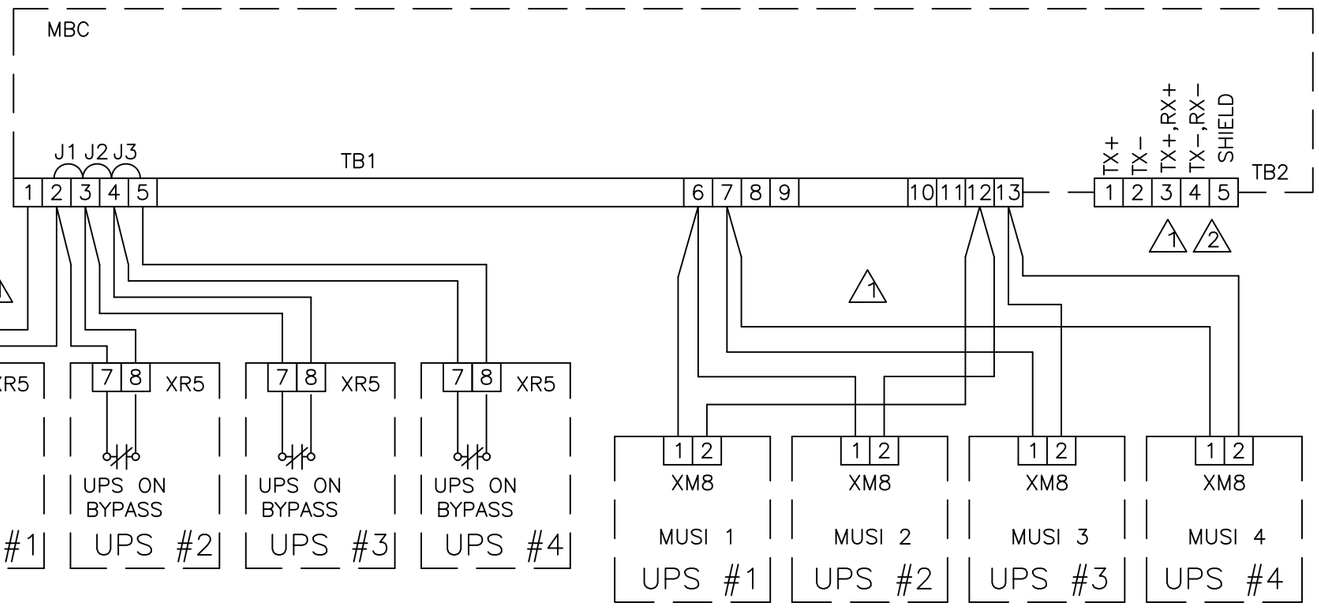
SINGLE LINE DIAGRAM



CONTROL WIRE ROUTING

DETAIL C

NUMBER OF UPS	J1	J2	J3
1	X	X	X
2		X	X
3			X
4	NO JUMPER		



1. ALL CONNECTIONS ARE PROVIDED AND CONNECTED BY CUSTOMER. RECOMMENDED WIRES: #16 AWG, 600V.
2. RECOMMENDED WIRE: #18 AWG 4 CONDUCTORS SHIELDED.

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Schneider Electric

TITLE: GALAXY PW 100 TO 225kVA MBC SYSTEM INSTALLATION

PROJECT: STD SUBMITTAL DRAWINGS | SHEET 4 OF 4

DWG NO: 90−133077−00	REV: A01
DRAWN: H DINH	31−MAY−02
ENGINEER: LNA	31−MAY−02
APPROVED: LNA	31−MAY−02

PROJ. ANGLE N/A